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ABSTRACT

This document is a report of the European and Third World Gender and Science and Technology (GASAT) conference. Formal papers and other activities during the conference were divided into four Frames. Frame 1 deals with problems, constraints, methods, and questions at the primary and secondary level in school with the most important focus being girls in school. Frame 2 includes contributions from the upper secondary level to higher education levels at the college and university level. It also includes teacher-training issues and students' attitudes to technology and industry. The focus of Frame 3 is women in the workplace. Issues included are opportunities for women, conditions of working, and career development. The problems and opportunities in developing countries are discussed in this frame. Papers that are in some way relevant to other frames are included in Frame 4. These papers have been grouped separately and raise ethical, moral, philosophical and methodological issues. Some of the speeches and the plenary sessions from the four Frames are included in this document. There are also samples from some of the round table discussions, workshops, and symposia. (KR)

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REPORT BOOK

EUROPEAN AND THIRD WORLD

GASAT CONFERENCE

MAY 6 - 11th 1990

"Science and Technology

a Future for All?"

Edited by
Ingrid Granstam
Inger Frostfeldt

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PREFACE

This book is a report of The European and Third World GASAT-Conference. (Gender And Science And Technology), organised from Jönköping University College, Sweden in May 1990. The theme of the conference was "Science and Technology, a Future for All?"

The national committee consisted of:

Ingrid Granstam	(coordinator)
Inger Frostfeldt	(secretary)
Birgitta Allvin	
Christina Chaib	
Solveig Mononen	

The ideas for the Conference programme and its overall structure were discussed in an international committee consisting of:

Ilja Mottier	The Netherlands
Magda Man in't Veld	The Netherlands
Anette Kolmos	Denmark
Doris Jorde	Norway
Anne Lea	Norway
Svein Sjöberg	Norway
Jan Harding	England
Patricia Murphy	England
Christina Ullenius	Sweden
Christina Chaib	Sweden
Ingrid Granstam	Sweden

Formal papers and other activities during the conference were divided into four Frames:

FRAME 1

This frame deals with problems, constraints, methods and questions at **the primary and secondary level in school**. The most important focus is the girls in school.

FRAME 2

This frame includes contributions from the **upper secondary level to higher educational levels** at college and University. It also includes **teacher–training** issues and student's attitudes to technology and industry.

FRAME 3

Women in the **workplace** is the focus of the content in frame 3. Issues included are opportunities for women, conditions of working and career development. The problems and opportunities in **the developing countries** will specially be discussed in this frame.

FRAME 4

In some of the papers the discussion is on a **metalevel**. In some way these contributions may be relevant to other frames as well. They have been grouped separately and they raise **ethical, moral, philosophical** and even **methodological issues**.

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In this report book, we have tried to reproduce some of the speeches and the plenary sessions from the four Frames.

There are also samples from some of the round table discussions, workshops and symposia. It's not a complete report of everything that went on during the week, but it still gives a picture of the full and varied programme.

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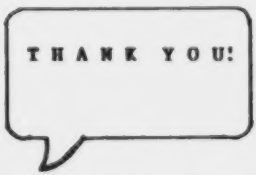
GASAT SPONSORS

County Administration of Jönköping
Labour Market Ministry
Magnus Bergvalls Foundation
Ministry of Education
Ministry of Industry
Ministry of Public Administration
Municipality of Jönköping
NCC (Nordic Construction Company AB)
Norwegian Association of Graduate Engineers
Saab-Scania
Swedish Association of Graduate Engineers
Swedish Council for Planning and Coordination of Research
Swedish National Board of Education
Swedish Natural Science Research Council
Trygg-Hansa
Wasa-Göta
Worldhealthfund
Vattenfall
Volvo AB

Chalmers University of Technology
Linköpings University, Department of Technology
Luleå University
Lund University, Institute of Science and Technology
Uppsala University
The Royal Institute of Technology, Stockholm

Financial support to third world participants from:
Studieförbundet Vuxenskolan (Adult Educational Association of Swedish Farmers' Union and the Centre and Liberal Parties)
BITS
SIDA
UNESCO



GASAT MAY 6 - 11th 1990 Programme

	SUN	MON	TUE	WED	THU	FRI
09.00 - 10.30		Speakers: I Granstam P Perry J Harding. General info	Plenary FRAME 2	Plenary FRAME 3 Speaker J Mehta	Plenary FRAME 4	Summary Frames 1 - 4 L Rennie, J Amara R Chakravarthy A Holmes
COFFEE 11.00 - 12.30		Plenary FRAME 1	Group discussions	PANEL DISCUSSION on Third World Issues	Group discussions R 2, R 7, R 11 R 12, R 13	Info about GASAT 6 and 7 CLOSING
LUNCH						
14.00 - 15.30	Arrival and check-in Sign-up for S, W and R	Group discussions	FIELD TRIP TO GRANNA - VISINGSÖ	W 5, W 6, W 9, S 2 Group disc on Third World issues	STUDY TOUR ELECTROLUX	W = Workshop S = Symposium R = Round Table Discussion
16.00 - 17.30		S 1, R 4, W 1, W 4, W 8		Posters from Frames 1 and 3 presented R5, R6, R9, R14		
19.00 - 20.30	DINNER and OFFICIAL OPENING Sponsors invited	Dinner	"Swedish Evening" with Smorgåsbord	Dinner	FESTIVITIES	
20.30 - 22.00		S 1, W 2, W 7, R 3	Meeting about GASAT Association	Posters from Frame 2 presented		

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WELCOME SPEECH

Ingrid Granstam

GOOD MORNING! This is the day we have all been looking forward to ever since we first decided, that this European and Third World GASAT conference would be held in Sweden.

I am very pleased, that so many of you could come and we all know, that the outcome of the conference depends on the participants and the sharing of information, and experience.

One important aspect of GASAT is the opportunity to meet with participants from other continents. The International GASAT Conferences have shown, that the problems of gender, science, and technology are worldwide. We are delighted, that although this is basically a European Conference, we have participants from many countries in other continents. With grants from SIDA, UNESCO and Vuxenskolan we have been able to invite people from Kenya, Nigeria, Tanzania, Sierra Leone, India, Central America and Jordan. You have contributed interesting papers on our different themes.

We are pleased to see old and new friends from the USA, Canada and Australia. Australia will host the next international GASAT Conference in 1991 so we can begin to discuss our hopes and plans for GASAT VI with them.

Many of you will know the history of the GASAT Conferences but for the benefit of newcomers I will tell it briefly. It all started in 1979 when several concerned researchers in Northern Europe met informally to discuss their work concerning the situation of girls in science and technology education. They proposed an international symposium and GASAT I was held in 1981 in Eindhoven, The Netherlands and was organised by Jan Raat, Ilja Mottier and Jan Harding all of whom have helped us with planning this conference.

Every other year since then international GASAT conferences have taken place and grown in size.

As the access of girls and women in scientific and technological fields was and still is linked with problems all over the world these conferences have provided a forum for many women and men working on projects about girls in science and technology, so they can meet together in order to discuss their research findings and experiences.

Svein Sjöberg, who has also been part of our planning committee, was one of the two organisers of GASAT II in Oslo in 1983.

Patricia Murphy who will coordinate the discussion groups here helped Jan Harding to organise GASAT III in London in 1985.

GASAT IV hosted by the University of Michigan was held in 1987 and was organised by Jane Butler Kahle. GASAT V was held last year in Haifa and was organised by Yael Rom.

In 1986 a regional conference was held in Elsinore in Denmark. In the same way this Swedish Conference is an intermediate regional conference to which we have especially invited participants from developing countries.

Our theme is, "Science and Technology, - a Future for All?"

Although the letter G in GASAT began by representing 'Girls', a decision was made following GASAT IV to change this to 'Gender' as we were concerned for both women and girls and for the wider interactions of gender with science and technology.

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To make this conference possible the programme committee and the persons, responsible for the different frames have worked hard together. I am convinced, you will appreciate our efforts with the conference book and the programme.

I have personally divided my work for this conference with a post as lecturer in Strength of Materials and Solid Mechanics at this fairly young University College in Jönköping.

To assist me is Inger Frostfeldt, who will be in charge of practical arrangements. You have received lots of letters from Inger during the last year and I think you have got to know her through them.

We have been a local group of five working on this project. You will meet Birgitta Allvin, Christina Chaib and Solveig Mononen when they introduce different items during the conference.

I wish you all five fantastic days when you'll make friends and exchange ideas and information, that will help you in the future.

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GASAT CONFERENCES: THE 80's EXPERIENCE

JAN HARDING, ENGLAND.

I have been asked, at the beginning of this Euro and Third World Conference, to give an overview of the GASAT Conferences and of the learning that they have generated. I accepted with some reluctance, partly because I believe that as little time as possible should be taken up at conferences by the presentation of formal papers and partly because I found the task somewhat daunting. Table 1 shows how many papers have been contributed to the conferences:

Table 1. International GASAT conferences: number of papers contributed and number of countries represented.

GASAT conference	Papers	Countries
1 Eindhoven, 1981	21	8
2 Oslo, 1983	32	8
3 London, 1985	70	21
4 Ann Arbor, 1987	132	30

For GASAT 5 the organization was somewhat different, as I shall explain later, so that I have not included the data here.

Papers represent only the formal input, however, and much learning develops through participation in discussion and informal contacts and these are idiosyncratic - each individual's experience will be different. I have been privileged to attend all the GASAT conferences, and the Danish Conference in 1986, so am, perhaps, in a better position than most to give an overview.

But what I say will be very much influenced by who I am, where I come from and how I see the world.

One of the things I have learnt through my involvement with women and science issues is how much one's view of the world depends on where one's base is. I was in Eindhoven working with Jan Raat when Argentina invaded the Falkland Islands - that was a learning experience. I had to wrestle with my own reservations about British actions in a context that was critical, if not hostile. I participated in a workshop in Ghana in 1987 for Commonwealth African countries, on sex bias in mathematics, science and technology education. I was one of only two white people there: it was a rich learning experience to accept both the matter-of-fact judgements made of ills arising from British colonial actions in these countries and the warm, generous welcome extended to me personally.

I found, in connection with this conference, that 'Europe and the Third World' seems only a small part of the planet from Sweden, but to Americans it might represent all the world but them - that shook me! We need to expose ourselves to the historical and cultural frames of others if we wish to understand, in the GASAT context, what forms the concerns for women and science and technology are taking. Exposure may bring its tensions and conflicts, but it is my hope that within the community that has developed through GASAT conferences we may learn to resolve these.

Origins

The first GASAT conference arose because those of us then working on the problem of 'Girls and Science' were meeting only on an *ad hoc* basis. We knew we needed to get together to share ideas and experiences. We owe a lot to Jan Raat and Ilya Mottier, who persuaded the Dutch Ministry of Education to finance the first conference.

Purpose of the Conferences.

So the purpose of a GASAT conference is to bring together those who are concerned about the alienation that exists between girls and women on the one hand and science and technology on the other. We expect participants to be working in some way to reduce that alienation.

A conference is intended to provide a forum for the exchange of views, information and experiences. This has influenced the structural plan of the conference. A conference is informed by both enquiry and action.

Participants.

Participants have been drawn from science educators, many with teacher education responsibilities, educational administrators and advisers, those working with engineering and computer education, student counsellors, project officers, those with formal responsibilities for equal opportunities, those involved in research as social scientists or historians and some working themselves as scientists and technologists. Each group may see the problem in a rather different way.

Conference organization.

1.Funding

Most GASAT conferences have been planned using an international committee to decide framework and matters of content, and a

national (or local) committee to raise sponsorship and to plan 'domestic' matters. The intention has been to keep the cost to participants as low as possible, for it is recognized that most will be women, and women do not generally have access to large amounts of funding. It is hoped that sponsorship will cover administrative costs and that participants will have to finance only their travel and accommodation. A number of conferences have made special arrangements to sponsor people from developing countries.

2.Contributory papers.

Participation has until recently been through a contributory paper. For most GASAT conferences papers are requested well in advance of the conference date so that they may be reproduced and distributed for people to read before the conference. This procedure is followed for a variety of reasons:

(i) to facilitate informed discussion,

(ii) to give more time for discussion,

(iii) to give all participants equal status.

Initially no attempt was made to screen or referee papers: the field was new and it was important to learn from the experiences of many individuals, how they perceived the problem, what responses were being made and with what outcomes.

3.Programme

A common pattern which evolved for the conference programme was as follows:

(i) the papers were organized into themes (or frames) usually related to the call-for-papers categories,

(ii) a theme was allocated to a particular day,

(iii) theme 'presenters' were identified - these were people who had considerable background experience relating to the theme,

(iv) at an initial plenary session in the day presenters were asked to remind participants of the main points contained in theme papers (referring to each paper), relate these to other work in the field and suggest questions which might promote good discussion,

(v) participants divided into discussion groups, with a facilitator and a recorder,

(vi) a time was set aside later in the day for special interest groups.

This procedure worked well while conferences were relatively small but proved problematic at GASAT 4 where some presenters had 30-40 papers to 'process'. Moreover, it became apparent that some participants were at a loss to produce a paper that made a significant contribution to debate.

It was at this point that the international committee for GASAT 5 proposed that alternative ways of participating should be provided: by organizing a symposium, a workshop, or a roundtable discussion or by presenting a poster paper. Many of you have taken advantage of these alternatives at this conference.

Although this arrangement has advantages it creates communication and choice problems. Some participants may wish to attend more than one parallel session (I know I do!) and a burden of responsibility

is laid upon the organizers of groups to see that their event is adequately reported in the conference report book.

4.Issues.

I have prepared a summary of issues represented in papers contributed to the earlier GASAT conferences (this can be found in your folders). One can see how perceptions of the GASAT problem have developed, reaching out to many areas of human experience, questioning assumptions and challenging ideologies.

At one level we are concerned to work within the system, asking how can we enable girls to participate in the sciences (computing, engineering)? They are areas that many of us find interesting and rewarding. They open doors to well-paid employment and lead to a greater empowerment for citizens. So we urge the development of more 'girl-friendly' curricula that take account of their motivations and interests as well as those of boys, and show girls and boys that women work in science and technology, not only now but in the past, contributing significantly through developments and inventions. At another level we angrily reject a science and technology that seems to derive from values leading to destruction and exploitation. We want engineering education to change not only to accommodate women, but to produce engineers who will save the world.

We reject biological accounts of the cognitive and affective differences we perceive between boys and girls and men and women. We seek explanations in the management of separation from dependency and the allocation of specific roles within power relationships derived from patriarchal systems. These are the explanations that match the experiences of the world for most of us.

The tendency for men to assume a dominant role became a conference issue at GASAT 2. Male participants were asked to meet to discuss the legitimacy and 'style' of men's involvement with women's issues. Svein Lie wrote sensitively about this in the Conference Report book.

Interactions between politics and GASAT issues are controversial - some believing that they should be kept separate, others that this is impossible since many political structures sustain the kind of oppression (maintained by technological power) from which we seek to free women. Following the Palestinian uprising in December 1987 there were protests from a number of former GASAT participants about the location of GASAT 5 in Israel. We attempted to resolve this through consultation throughout the major part of 1988. The final decision of the International Committee for GASAT 5 was that we should honour our commitment to the convenors, whose offer we had accepted in 1987, but that a European Conference should be organized for 1990. The Swedish organizers decided to raise sponsorship to invite members of developing countries to participate also.

A further conference-related issue remains to be resolved: the status of papers contributed to GASAT conferences. Should we impose selection, if so, by whom? It has been the practice to print more copies of the sets of papers than are required by participants, so that they may be available to institutions and future 'enquirers'. The papers therefore become the yard-stick by which GASAT, and those who are associated with GASAT, are judged. I have heard disparaging remarks about 'quality', which I have countered by querying the criteria used to judge quality (it sometimes has to do with research methodology about which there is legitimate debate) and by pointing to the purpose of papers within the structure of a conference.

We still welcome papers from countries not previously represented which give the background to the GASAT problem found there. It is hoped that other papers can be placed, wherever possible, within the context of past debate. We know however, there is a problem of communication - past collections of papers are not too widely distributed. Gender and science research is published in a wide range of journals, as anyone who has attempted a literature search will be aware. We had hoped, at one time, to have our own journal

sponsored by the publishers of the International Journal of Science Education, but the decision went against us at the last 'hurdle'.

We have divided the papers into two categories this time:
,i) research and analysis and (ii) reports. Is this helpful?

- What should our policy be?

Questions for the future.

The rise of the environmental 'green' movement has provided support for our concerns about the destructive impact of science and technology on the environment. Does it have greater power to change that impact than a movement based on gender concerns? Will 'caring' men feel more comfortable within it than in one with 'feminist' associations?

Is the green movement enabling males with different value systems from those recruited in the past to enter engineering education? What will happen to those males as they proceed through employment? Will it help women to enter more readily into technology related careers?

What phase have we reached in our work for girls/women and science/technology? What additional research is necessary? How are girls and young women responding to the greater attention given in many 'western' countries to women's contribution to the economy?

Have we reached a 'hard slog' phase involving consolidation and watchful monitoring? Do we need to develop more effective networks and pressure groups? What will be the most useful function for GASAT? These questions will form part of our debate at this conference.

Some of you will be attending a GASAT conference for the first time. I hope this review of our purposes, our past and our problems will help you to place this conference in context and has made you feel more 'at home'.

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Frame 1

Primary and Secondary Science

Doris Jorde
Anne Lea
Magda Man in't Veld

INTRODUCTION

Before we begin our formal presentation today, we thought it might be nice to present a scenario, - a dramatization, - which illustrates one of the problems we have in getting girls interested in science and technology.

We have chosen a scenario developed by the McClintock Collective in their book, "Getting into gear". Two of the papers in frame 1 are written by members in the McClintock Collective, Gaell Hildebrand and Sue Lewis.

Scenario 1 begins with a little girl named Lisa Jane:

As a baby, LJ was treated as a princess. People would pick her up carefully, smile and tell her that she was pretty. They would give her nice dolls to dress and the tools she received were for imitation housework. When old enough, she helped Mum with home duties and had less time for play. LJ loved hearing stories about helpless princesses and fearless princes. She gained acceptance for being kind, quiet, nurturing and engaging in passive play. LJ was admonished for aggressive, raucous behaviour - she was told to 'act like a lady'.

At primary school, LJ found that she was often chased by the boys and the implied threats of violence led LJ and other girls to limit themselves to a corner of the available space. This limited her physical play. She learned that by being a passive, dependent, obedient student who finished work neatly and on time she received positive feedback - she was told she was 'a good girl'. The teacher did not pay much attention to LJ at all - she'd learned to play by the teacher's rules. LJ was good at maths and reading. she did not do much formal science at her school, and did not experience much informal science during play. LJ loved school.

At high school LJ found that being a teacher's pet and conforming to teachers' rules (which had been appropriate in primary school) meant that she was ignored. The teachers took a long time to learn her name and she seemed to be identified as being among a group of girls rather than as an individual. LJ was still quiet in class and lacked confidence to ask questions. When she did, she received put-downs from the boys which seemed to go unchecked. When she was criticised by the teacher, 9 out of 10 times it was associated with her ability and not her behaviour - so when she failed a test she

attributed the failure as being due to her lack of ability. LJ lost confidence and self-esteem.
The other girls began to talk not of cabbage patch dolls but of hair gel and make up. LJ began to worry more about her appearance and less about school.

Teachers did not talk to LJ much about careers nor did they seem to have high expectations of her. they had higher aspirations for the boys with respect to careers. She responded by lowering her expectations accordingly. LJ expected that she would get married anyway and so would only need a job for a while.

LJ didn't like maths and science. Her Mum said 'don't worry dear, I wasn't any good at maths either'. So it was OK to drop down to consumer maths in year 10. Anyway, she loved French and they had blocked French against the higher maths option - so the choice was made even easier. LJ found that she could not relate to much of the science taught. She was interested in people and society - how the science was related to her everyday world, but the science taught focused on objects and used language and skills that she simply didn't have. She felt alienated.

LJ, like most of the other girls in her year, decided to do biology - because it was interesting and it seemed like the right thing to do.

Scenario 2

As a baby LJ was rolled around, tossed in the air and spoken to aggressively. People referred to her as 'mate' and she was told whe was big and strong. When older, she was given transport toys and construction sets, LEGO, and lots of toys with batteries and electric motors. When they broke, LJ and her Dad would fix them in the workshop. He taught her how to make billy carts and a cubby house in a tree. They played cricket and football.

LJ was praised for self-reliance - she had little support system or avenue for being natured - her parents and others told her 'big girls don't cry'. She sought refuge in things which would not let her down - objects. She would play, manipulate and place great store in the constancy of objects.

At primary school, LJ was aggressive and liked to chase and threaten other kids - she could play where she liked and experienced a lot of physical activity. Because LJ was loud and boisterous she received a lot of teacher attention - but this was usually associated with her behaviour. She learned to get attention via behavioural and sporting avenues. The teacher attributed LJ's lack of success in tasks as being due to lack of motivation and assured her parents that LJ 'could do better'. There was not much science done at school, but LJ learned a lot of science through her play activities with motorised toys, magnets, physical games etc. She did not like school or teachers much.

At high school, LJ continued to receive lots of attention but her behavior seemed more acceptable. . At high school it paid to be assertive, self-assured, prepared to try new subjects, to take risks, to operate independently. LJ began to like school more.

When LJ received criticism it was more likely to be associated with her behaviour than her ability. When she failed a subject she would more often than not, assign blame to the teacher, or last night's basketball match - external factors, rather than blame herself - she would do better next time. The teachers agreed.

Teachers and her parents had great expectations of LJ, and she tried to live up to these. She chose subjects with future career prospects. LJ studied maths and science because her Dad and teachers said it expanded her career options and also she was familiar and comfortable with the language, concepts and examples. She could relate to the stuff about batteries and ball bearings and motors because it was all part of her experience. She had lots in common with the other students with similar background experience and with her teacher. He would always give an example she could relate to. LJ was used to competition and so enjoyed the way science and maths was presented. She liked the tests because usually she didn't have to write much.

LJ decided to do physics because she wanted to be an engineer - it seemed the right thing to do.

What is the point of this presentation and what does it have to do with primary and secondary science education?

The problems existing in science education for girls do not exist just within the four walls of the classroom. Being a girl in any culture has certain meanings that must also be considered when we try to understand why girls do what they do, why girls make the choices they make. Our dramatization demonstrated what goes on with the upbringing of girls in a western culture. Similar situations most probably exist in other cultural contexts.

Social and cultural definitions also have great influences on what goes on in classrooms and we can never underestimate the importance of ones culture if we are trying to influence change. Girls and boys who have stereotypic socialisation experiences, as Lisa Jane did, do not develop the same scientific skills.

We have to accept and value the fact that each child comes to the learning situation with different background experiences. An inclusive science will use and extend the strengths of an individual and build on the deficiencies in experience, (note, - not the deficiencies in the child), in order that they become strengths. There are qualities which should be valued and developed in all students.

In this presentation we will try to place the papers into the greater context of science education. It is important to always ask ourselves what we have learned, where we are and where we need to go in the future?
In frame 1 we will also attempt to place the papers into the greater context of science education, always trying to ask ourselves what we have learned, where we are and where we need to go in the future.

SUMMARY OF THE PAPERS

We have received eleven papers that deal with primary and secondary education. The conference book, which you have already received, contains eight of these papers. Three

papers came in later, and will be published in the supplement of the proceedings.

To give you an overview of the content of the papers that deal with this particular issue, I propose to say a few words on the following subjects:

Measures derived from girls' experiences with current science education;

New concepts about science education for girls and boys; and

The influence of classroom climate and teachers.

1. *Measures derived from girls' experiences with current science education.*

In a report published in 1978 by Her Majesty's Inspectorate of the Department of Education and Science in Great Britain it is stated that the differences between boys and girls in science education are due, at least partly, to the approaches and curricula of the schools. There appear to be considerable differences between schools. It is very difficult to explain these differences without taking into account the influence of the schools.

The report states that fifteen schools were visited, in which a relatively large number of girls were following science courses. The purpose of the visits was to find out and describe which practices appeared to be helpful to girls taking science. On the basis of the observations it was concluded that some measures seemed to give particular support to girls.

Since then many publications have recommended a variety of measures, that cope with striking aspects of the girls and science problem, as observed in ordinary lessons.

What do the papers say?

The paper of Tertiv Ato from Nigeria focused on how factors relating to the school and the teaching of science influence the attitude of girls.
He asked: "How does the school and the teaching affect the attitude of girls towards science?"

From his quantitative study of science education in Nigeria he concluded, that girls' enjoyment of science lessons correlated highest with their attitudes to 'science books', 'practical work', 'the science teacher' and 'scientists'. Furthermore single-sex schools, schools in urban areas and schools with well-equipped and well-used laboratories appeared to have a positive influence. He found that the perceived difficulty of science differed significantly between schools.

Helene Sørensen from Denmark focused on what is going on in the classroom when girls do physics - and like it.
She asked: "Do girls remain interested?"

From classroom observations she concluded for instance that girls to a higher degree than boys preferred the topics in physics and chemistry that can be related to phenomena in nature or be put into a personal or social context. Especially in grade 7

it was characteristic that girls needed reasons for the importance of learning that go beyond the internal reasons for teaching and learning the subject. Boys could be satisfied with science lessons just because they were fun. Although girls had more demands about understanding what they are doing, both girls and boys liked practical work. In the observed classes where girls did physics - and liked it - it was common that the pupils had some kind of self-determination.

Luigia Bosman from Italy described how children in primary education can learn to do experiments and explain their ideas about these experiments. By doing this, she stressed, children can acquire a sense of competence and a feeling that they will be able to cope with the subject later on.

The paper of Magda Man in't Veld, Ton Jörg and Theo Wubbels focused on girls' appreciation of and feelings about physics lessons in the Netherlands.
They asked: "Do girls' experiences with traditional and innovative physics curricula confirm the effectiveness of proposed girl-friendly measures?"

From the qualitative part of their longitudinal study they concluded that generally at the age of 13 girls are open-minded about the physics lessons and willing to learn more about physics. But when the girls are 15 years of age and have already taken physics for two years, many of them have changed their minds and now feel that physics is not applicable and not of any interest to their own lives.
Girls often do not see the resemblance between what they learn at school and what they come across outside school unless they are given concrete examples by their teacher and in their textbooks, and girls more than boys have the experience that the difficulty of physics lessons increases with time.

Their conclusion was that physics education for girls cannot be ameliorated simply by some isolated measures. A more coherent approach throughout the curriculum is necessary.

2. *New concepts about science for girls and boys*

Gaell Hildebrand and Beverley Dick from Australia introduced the idea of gender-inclusive science education. Gender-inclusive science education utilises the strength of all students. It closes differential gaps in prior experiences.

To achieve the goal of gender-inclusive science education, they argued, it is the content which has to be changed. It has to be reconstructed as a cooperative and human activity. Inclusive science teaching does not exclude any language, content, resources, entry points, teaching methods or classroom interaction patterns.

According to Sue Lewis gender-inclusive science education enables girls to participate actively and to experience success in science. In her paper she explained how the McClintock Collective in Australia applied the methods of action research in what is called the GAMAST-project. New approaches to science education were developed and disseminated in close cooperation with teachers. Depending on the teachers' perception of the success of an activity it was either further developed or altered.
In their paper Gaell Hildebrand and Beverley Dick described three teaching strategies out of the more than forty that are the outcomes of their work over six years in

Victoria, Australia. The given examples are:

- creative writing,
- drama (including human models and role play),
- tinkering.

Renate Schultz-Zander described two projects which she conducted in Germany for the purpose of developing strategies to prevent discrimination against girls and young women in the field of information technology.
She asked: "what concepts and strategies might lead to equality?"

She reported how she helped to organize a curriculum conference of women with various skills, who were invited to answer this question. The conference resulted in recommendations for aims, contents and methods which resemble those of the gender-inclusive approach to science education just mentioned.

In addition she outlined the concept of 'Computers and Creativity courses'. She illustrated how such a holiday course for girls aged 13 - 16, aimed at enhancing girls' self-confidence and at stabilizing their identity. In this course attention was given to the role-conflict that faces girls when they use information technology. In talking about their former experiences with informatics at school about half of the girls said that they enjoyed the idea of being successful. Others felt isolated, left out, emotionally over-taxed and annoyed. She stresses that female and male educationalists must help to overcome the traditionally determined roles of pupils.

Patricia Murphy and Anne Qualter looked at the gender-inclusive aspects of pedagogy in traditional classes. These were investigated in a number of national surveys and in-depth research studies among 11, 13 and 15-year old pupils in Great Britain. The concept of gender inclusive science education enabled them to point to some of the critical aspects of traditional science education.

They stressed the importance of the relationship between out-of-school experiences of girls and boys and their performance in school. By doing so they argued a point of view that differs from the conclusion of Allison Kelly in her paper for GASAT-4. In addition, they drew attention to the fact that girls and boys are aware of different aspects of problems and they have a different understanding of relevance. It is essential for assessors to interpret pupils' responses in the context of the tasks as they are perceived. This is especially important if the results are to influence curriculum planning. Girls actually see more difficulty in tasks than the teachers intended because they first have to eliminate the variables which they consider relevant. Patricia Murphy and Anne Qualter concluded that, as long as cultural expectations remain unequal, it is essential for teachers to establish girls' and boys' different images of the world, in order to avoid alienating the girls.

3. *The Influence of Classroom Climate and Teachers*

Anita Alting and Erik Payens from their pilot study in the Netherlands identified the problem of teachers who have poor communication with their female pupils. They seemed to overrate the girls' understanding of concepts, they did not know the girls' future plans or their interests very well.

Juliana Amara from Sierra Leone in her paper firstly raises the point that socio-cultural factors do present a barrier to the science education of girls. But after that she indicates that their is a second dilemma which is just as important and which has been created by the general economic malaise in developing countries.
If teachers are not kept up-to-date by means of in-service training, if science lessons happen mainly by the traditional lecture method, when there is no science equipment and teachers themselves have problems such as low salaries, the science teaching will not be very effective.

Sue Lewis in her paper described the GAMAST-project which provides guidelines for developing workshop activities to change the teacher's classroom practice. She stressed that innovation in education is a risk-taking activity for teachers and researchers.

Conclusion
At first sight the concept of gender-inclusive science education seems mainly useful because it adds some pioneering strategies to the already suggested measures for a girl-friendly science education. But in addition, as Patricia Murphy and Anne Qualter explained in their paper, the concept of gender-inclusive science education also enables us to understand the nature of the differences between girls' and boys experiences in science education.

ISSUES IN PRIMARY AND SECONDARY EDUCATION

Those of us who do research in science education see the issues of gender-inclusive science as one of many different important considerations in teaching and learning science. The following is a brief description of what science educators concern themselves with when defining a good science education. The underlying aim, of course, is that gender-inclusive science be related to all areas of science education.

Content - Content is the reason for teaching science and technology courses. We have a defined body of knowledge which we refer to as "science" which we mean is important for others to learn.

Processes of Science - The processes of science are the way we go about "doing" science. Observing, Collecting Data, Classifying, Communicating, Controlling Variables, Hypothesizing, Predicting, are all involved in the process of science.

Methods - Methods are best described as the way we choose to communicate the science we wish to teach. Everything from lectures, to group work, to bulletin boards constitutes the methods part of science education.

Learning Theory - Learning theory is extremely important for us to know about if we wish to meet our students at their level of understanding. Concepts presented to early or at a difficult level of understanding may be of little interest to our learners.

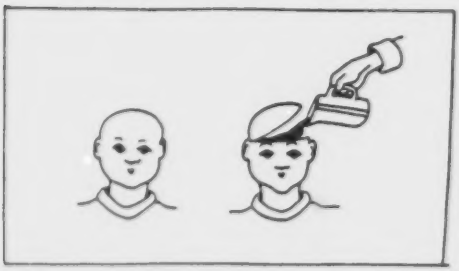
Whose Science - Who are we teaching this subject to, and for what reasons? Children in our schools today will be facing a world in 20 years that will look very different than the one they live in today. Science lessons must equip these students with the skills they will need to be responsible citizens, able to make responsible decisions. At the same time science must be able to generate a pool of new scientists. Science for the

citizen and Science for the future scientists begin in schools as the same thing but eventually develop into two different specializations.

Teacher Education - Enough emphasis can not be given to how important teachers and their education are to making successful science programs in schools. Many of the gender-issues in science education stem from the fact that teachers (mostly women) are poorly prepared in the sciences and a negative spiral is allowed to exists with regards to girls and science.

Attitudes - The attitudes children and adults have towards science and scientists greatly influence the future of who is "doing" science in this world and who is making scientific decisions. Science often is associated with a negative image, especially for girls. This image must be dealt with by science educators and scientists is we are to recruit scientists from all walks of life.

CONCEPTUAL CHANGE LEARNING



The traditional picture of learning was often thought of as a child (learner) and a teacher involved in a one way interaction. What we think we are teaching in the science lesson is not always what children are hearing or learning.The teacher has information (knowledge) which is passed on to the child without question. The teacher is the giver, the child is the learner.

But children often have their own ways of interpreting the world which can differ from the "scientific" explanation of how things are. We use the teams, alternative conceptions or misconceptions to describe these explanation which often can hinder learning.

Conceptual change learning makes use of strategies that allow teachers and children the opportunity to explore the concepts that already exist in their own thinking, then make an assessment of what they will do with those existing concepts based on new information. The following points are basic to conceptual change learning:

1. The learners existing ideas are important and need to be explored and examined
2. The learner is responsible for her own learning. No one else can make a person learn something.
3. Motivation towards learning is a key element in the learning process
4. Once existing concepts are examined together with new information, the learner has the choice of changing the existing concept or keeping it just as it was.

There is much to be done in this area of research, especially when we consider that gender issues have not been examined.

The Primary Science Project in Norway has been investigating the use of writing as a means of exploring existing concepts. We give children the opportunity to write all they can about a science topic. Usually everyone has some association to these topics - it just takes some children longer to realize it.

After writing, the children are asked to read what they have written to each other. The children listening are asked to hear what others wrote that they perhaps did not think of. Comments must always be of a positive nature.

We finally extend these writing assignments into questions children have about the topic and eventually bulletin boards where the questions are placed and hopefully answered over time.

Writing is a powerful methodology for uncovering and learning information. A simple assignment described about provides information for children, teachers and even researchers.

Children - through writing children are able to see just how much they do know about a topic. Most of us have some kind of association to things around us, even if it is not the "scientific" view. Since everyone in the class writes, everyone has something to offer when the teacher opens the hour up for discussion. Many of the McClintock ideas also use writing techniques to engage pupils and arouse their interest in science.

Teachers - teachers are able to use the writing assignment to find out just how much pupils do know about any given topic. The questions raised by the children also help her to plan the unit according to that which the children are interested in.

Researchers - we have been using writing assignments to help us identify the alternative conceptions children have to a given topic. Writing is also a valuable diagnostic tool for evaluating curriculum materials and teaching.

WHAT MAKES A GOOD SCIENCE TEACHING?

The title could as well have been: "What makes a good gender inclusive science teaching?". We think that a good science education is a good science education for both girls and boys. Recent research and policy reports mention specific measures for improving science education. In her paper, Madga Man in't Veld summarizes the proposed measures in a list of eight points, and gives some references to other papers and books. The main aim of the list is to make science education more attractive and valuable for both girls and boys. In this frame we would like to pinpoint a few aspects that we have found important in good gender inclusive science teaching.

Build on activities

Closing the current gap between girls and boys in science cannot be done by the "chalk and talk" method. It is commonly accepted that good science teaching needs to provide students with experiences and activities. But activities alone are not enough. In her book "The Pupil as Scientist" Rosalind Driver turns the often used slogan "I do and I learn"

into "I do and I am even more confused". The constructivist view of science also indicates the fallacy here. If we wish children to develop an understanding of the conventional concepts and principles of science, more is required than simply providing practical experience. The theoretical models and scientific conventions will not be "discovered" by children through practical work. They need to be presented, and guidance is needed to help children assimilate their practical experience into what is possibly a new way of thinking about them. But activities are necessary as a basis for learning.

Structuring the teaching

Have you ever met a little girl who claims that she likes the tests best in school, - because then the classroom is quiet? We have, and to us this little girl tells us about her need for a structured classroom environment. In the Norwegian Primary Science Project, Doris Jorde and Anne Lea report on the consequences of unstructured classroom on girls and boys. They point to the importance of an activity based science teaching, but stress the fact that the teacher must be in control of the classroom. She has the responsibility both for the scientific content and the pedagogical methods used. Unstructured lessons tip the girls off. Even if the lesson is full of guided activities, it does not help if the environment is too noisy and rough. Girls tend to withdraw and one may even question how much learning is going on for the boys as well.

The way a teacher organizes the activity is very important. To give you one example we will tell you about the teaching of magnetism in two different classes. In one class the teacher began the lesson by asking the children: "What do you know about magnets?" All the boys answered, some telling correct things about magnets and others just nonsense. Not a single girl was saying anything.

In another class the teacher opened the lesson by handing out a magnet to every single student. The teacher told them what they had gotten and asked them to play with it and find out what was attracted to the magnet. After a while she asked them what they had found out. Now all the students in the class were engaged, and the girls as well as the boys answered. What the teacher had done was to give all the students in the class a background and something to refer to. A good teacher provides the students with activities and experience, letting them go, but bringing them together again. That is very important for the girls, and as Jan Harding said at the GASAT-conference in Ann Abor: "It doesn't seem to harm the boys!"

Variety of presentation forms

One of the things that research tells us, is that a lot of different presentation forms should be used during a teaching unit. One of the strengths in the work of the McClintock group is their suggestions of different presentation forms and working forms in the science lessons. They have tried out many different things and it is fascinating to read about it. We hope they, in the future, will be able to evaluate the science outcome of the different methods. This type of information would be of great help to science teachers.

A lot of research points to the fact that science content must be linked to "everyday life". Magda Man in't Veld tells us that when girls were able to give examples of the ways in which knowledge of science is applied outside school, they cited their teacher

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or their textbooks in most cases. That places a big responsibility on the textbook and the teacher. Have we as researchers been clever enough to tell textbook writers how important this aspect is?

Co-operation and group work

"Working together" and "working together" could mean a lot of different things. Educators in different counties are trying out ways of co-operative learning. Some of them seem to have a positive influence on learning both for girls and boys. To make the students really work together means more than just sitting next to each other. The results of co-operative learning methods tell us that more attention needs to be paid to pedagogical-methodological features of the actual curricula and the teaching methods.

Tortive Ato from Nigeria says in her paper that: "..Teachers are capable of substantially changing the females views of science and that the science teacher should be the most important resource in science education." We all know that good teachers mean a lot to us, but at the end of this "frame 1" we would like to point out your responsibility as researchers. From research we know quit a lot about what makes a good science for girls, and you will find references to it in the GASAT-papers.

We, the researchers in this important field of gender inclusive science, have much to do at this point in time. Information from research projects needs to be disseminated to teachers in classrooms, to textbook writers, to policy makers. Is it not also our responsibility to accept this task? The challenges and tasks are many and we are the ones who will ensure that girls, over the entire world, have a better chance to realize their potentials in science and technology.

FRAME 2 , PART ONE, by Anette Kolmos

HIGHER EDUCATION AND TEACHER TRAINING.

This frame was divided into three topics:
Choice of Higher Education, presented by Anette Kolmos, Denmark
Women in Higher Education, presented by Hanne Koch, Denmark
Teacher Training, presented by Ilja Mottier, The Netherlands

CHOICE OF HIGHER EDUCATION

Anette Kolmos

I will start by saying a few words about the nature of gasat activities and secondly I will comment on the submitted papers concerning the choice of higher education.

1. THE NATURE OF GASAT ACTIVITIES

I have chosen two aspects to illustrate the nature of gasat activities. First, who are we at GASAT discussing how to get women into higher education - and discussing what to do when women have entered the level of higher education?

Secondly, I will comment on some aspects of the current trends according to the past and the present papers.

1.1 Who are we?

I cannot help commenting on this question, because in higher education it is so seldom you see people crossing borders.

We are a unique forum. You will find people at all stages in the educational system and people with many different professions,

e.g: researchers, teachers, equal opportunity advisers, student guides, policy makers.

Especially in higher education you will find people from all study subjects, e.g: humanities, social sciences, natural sciences, technology and engineering.

You will find a unique "integration" of research papers and reports describing activities based on experience. This combination has always characterized GASAT and has given a fruitful forum to inspire each other and develop new strategies.

This combination has not always been easy - because we are not only representing different subjects, different cultures, different professions, different languages (both national and subject languages), but we are also representing different political views - and especially, different political views towards the recruitment of women into science and technology.

We have e.g. still discussion whether we shall recruit women based on the arguments of the intelligence reserve - or whether it shall be because of equal opportunities on the labour market - or because we want to humanize the stereotypical male-dominated world of technologists and scientists.

We still have discussion whether we shall change the women or the subjects, the scientific methods and the way they are taught in school. One of the banal - but wise - questions has been: Is it the women who reject science and technology - or are science and technology rejecting women???

In spite of all the differences, in spite of political and strategical disagreements, and sometimes I tend to say because of these disagreements, GASAT has been and is a forum where you get the inspiration - and where you are learning. My experience is that I am reflecting my own culture, my professional background, my role, my political opinions - and I am getting

wiser.

1.2 Current trends

I will not go into all details of the current development, because what is happening is very complex and difficult both to analyze and describe. The theoretical framework and the use of empirical methods e.g. have developed during the last 5 years; you will find more research projects using quantitative methods instead of qualitative methods even without reflecting the methodical validity. The recruitment activities have changed from mainly national activities to institutional activities.

This development has not only been for the better. On a more general and external level, research is evaluated - mostly by quantitative criteria such as the number of articles published in the "main stream journals". We must ask which impact this evaluation may have on the choice of issues and research methods. Institutions are in competition; within the same resources they both have to grow and develop qualitatively which simply is an impossible demand. We must ask how this development influences the recruitment strategies.

On a more internal GASAT level, we are dealing with gender issues now instead of women's issues in our research projects. In the present papers you will see analyses of both men's and women's choice of education and their situation in the study - but as I mentioned, it is quantitative methods which have been used. I hope the use of quantitative methods expresses a stage in the development from a focus on women to a focus on gender and I am looking forward to more qualitative studies comparing men and women. I am doubt e.g. whether it is possible to catch gender differences in the attitude to technology and science - or in the perception of the study. Further, I will maintain that it is results from both qualitative and quantitative methods which challenge the theoretical framework.

Looking at earlier research, you will find many qualitative and quantitative surveys evaluating women's choice of a scientific or technological higher education by analyzing their situation at the study. Of course the theoretical framework has interpreted the results - and looking at the empirical surveys made 6 years ago, you will find discussions of women's coping strategies.

Beyond the concept coping strategy you will find not only a researcher perception and a theoretical framework based on the contradictionary and reductionary perception of women on the one hand and science and technology on the other. Beyond that concept you also find the perception that it must be problematic being a women in a male-dominated study.

I want to stress these "old" research results, because in the present papers you will not find the concept coping strategies - but you will find several papers which deal with the question whether there are differences between men and women in higher technical educations.

In general, the results are based on questionnaires and the conclusion is that we do not find any significant differences between men and women either in Holland, in Spain, or in Denmark. These results give opportunity of reflecting: was the concept of coping strategies, based on a theoretical framework on women's and men's values 5 years ago, wrong??

- or is it not possible to catch different values by using questionnaires?

- or did we in blindness project our own feminist visions and hopes on to the women in science and technology without reflecting on our own subjectivity, our own hopes?

- and if so, is this one of the reasons why we have seen the elephant walking around in the room - the elephant as a symbol of the controversitivity between sociologists on the one hand -

and technologists and scientists on the other hand.

Sociologists have been claimed to treat women in science and technology as objects - on the other hand, women with a background in science and technology have been claimed to not being critical "enough" towards their own professions.

I will not give the answers but only raise the questions and let you decide if this is still a problem.

2. THE CHOICE OF HIGHER EDUCATION

Concerning the topic choice of education the questions have been and are: What are their motives for the choice or non-choice of science and technology. What are the barriers - what has to be done?

One of the barriers has been and is the non-choice of science and technology at earlier stages in primary and secondary schools. Some would call it the lack of "competent qualifications" in the sense that women's choices of disciplines or of the lines in upper secondary school do not correspond with the entrance criteria at higher technical and scientific educations.

Further we know that the choices of subject made in upper secondary school determine the students' choice of engineering branches and the choice of other scientific disciplines.

The strategy has been to involve all the actors in the educational process, especially in upper secondary school and make them aware of the gender aspects both in their own behaviour and in the students' choice.

This means that GASAT has made a close interaction between higher eduction and upper secondary school - and that all the actors are in focus: Students guides, teachers, and all the topics are

in focus, e.g. teaching style, scientific cognition and so on.

Building up the body of GASAT has been one strategy - because we are all aware of the fact that the non-choice of science and technology does not only occur at the level of higher education - but is part of the whole educational process from the pupils' entrance in primary school - and even before that.

One of the first and most important pieces of work that has been done is statistical survey of the number of women and men in the different disciplines both at upper secondary school and at university level. We must not forget that "gender-free" statistical information still exists - and at many institutions we won a battle when we got information on the number of women in higher educations.

Unfortunately, that battle is not finished yet. This is an ongoing activity in many countries.

Shadia Ahmad Tel from Yarmouk University, Jordan, has described the number of women in different disciplines at upper secondary school and concludes in her paper that the potential pool of women choosing science and technology at university level is growing in Jordan. During the last 20 years the percentage of women has increased from 20% to 37% at 2nd grad in upper secondary school (17 years) in Jordan. Also the percentage of women entering science at university level has increased.

Compared with other countries this development in Jordan expresses an international trend. At upper secondary school level the number of women choosing scientific streams have increased.

A number of barriers has been pointed out. Lack of knowledge of science and technology and bad images is and has been another barrier. Good possibilities of employment and career choice, interesting work, engineering is "not dirty" have all been slogans trying to change the images.

Campaigns, journals, exhibitions, pamphlets were spread out at the upper secondary schools, mostly funded by governments, engineering societies, employer societies, because they were concerned whether the intelligent pool of bright young people would be big enough - if the pool only contains men.

Two of the present papers deal with the image issues. Alan Durndell from Glasgow College has written the paper: "Why do female students tend to avoid computer studies?". The title of the paper tells the story. Women do not choose computer studies. Actually, the number of women choosing computer studies has declined - not only in UK - we find the same trend in Denmark.

Results from this survey are that computing has a very poor image. Especially women - but also men - express the wish to work with human beings - not machines, and that computing is perceived to be like sitting at a computer terminal most of the time. That image discourages many students.

Many respondents say that computing is too specialised and has too narrow employment opportunities. However, many women take a few computer courses combined with other disciplines.

The survey also shows that the students have a lack of knowledge of what computers are. Many students - and again especially the women, had no or little contact with computing before university.

The strategy must be not only to change the image of computer science, but also to give students the possibility combining computer courses with other disciplines - and to teach more computing at primary and secondary schools. Further, Alan Durndell emphasises that from a feminist point of view " the only strategy that would be acceptable would be a thorough reorganization, both of the content of computer courses and of the way that they are taught and published" (Contributions GASAT Jönkoping, Sweden, 1990, p. 60).

I find this point rather important, because changing image may result in changing the shell and creating new myths. The image must be correlated with the content in the educations or the work.

Changing the image of computing may e.g. not be changing the image of sitting in front of a terminal the whole day - because a lot of people are sitting in front of their terminals - but it must be to change the perception that it is boring to sit there - and that computing gives many employment possibilities.

So be aware of which images we are going to change.

Andrew Gale, South Bank Polytechnic, London, also states the importance of images - but images in the construction sector. The aim of this project is to find out why only a few women are occupied in the construction industry in Britain. 20 men and women - both students and graduates - were interviewed.

The initial findings are that the construction industry also has a very poor image which influences women's choice. However, the most important reason is probably women's knowledge of the construction industry - or rather a lack of knowledge. My question is where are we going to teach more about the construction industry or more computer courses? Is it in primary and secondary schools? Is it a task for teachers or students guidances? Is it a new subject? - if yes, what about the problem with "subject-overload"? Are we going to cut down humanities? Or is the strategy to develop recruitment material on the missing knowledge?

Other barriers have been revealed and special attention has been paid to mathematics and physics.

Silvia Chavarra, University of Costa Rica, emphasises the number of mathematic courses which influences the choice of higher

education. Silvia Chavarra had divided the different university lines according to the number of required mathematic courses. Physics, mathematics, engineering and computer science are the lines which require more than five mathematic courses. Silvia Chavarra concludes that: "Because they (women) have difficulties or feel unsure with mathematics, women are being discriminated or are discriminating themselves from careers that require mathematics courses" (Contributions GASAT Jönkoping, Sweden, 1990, p. 208).

We are confronted with a number of cultural factors. In Europe the barrier is not mathematics - but physics. In Europe we have a lower number of women in computer science. - and I am still wondering why? - Why is it so?? Why do we still find physics as the filter in engineering in Europe and mathematics as the filter in engineering in USA? - Apparently, there is no problems concerning physics in engineering.

We need comparative studies pointing out the actual and exact cultural factors.

In my own paper, I am asking the students which motives they found important in their choice of engineering. Men and women give different motives. Interest in technique and interest in mathematics have scored the highest percentage and have a significant gender aspect, as men mostly choose because of the interest in technique and women because of the interest in mathematics. This result illustrates the important roles the educational system has in breaking down the wall into science and technology.

In earlier GASAT contributions, you will find a goldmine of papers describing and evaluating activities, developing new ideas of how it may be possible to recruit more women into higher education. The papers are reflecting and openminded - describing the good examples and the bad examples.

There is only one paper at this conference within this frame which evaluates the activities recruiting women into higher education. It is written by Loes Marinussen from the organization: women and higher technical education, Holland. Especially, the written material - a higher technical education guidance - is evaluated. 7 women drop outs were interviewed. The results were:

- Written material has an important role, because mostly, it is the first information women look for.

- In the written material there was no information about women's career opportunities.

- Be careful that the orientation days do not give an information overload - and do not overemphasise the practical aspects of the education. (My personal note - Loes Marinussen is evaluating the technical college - and not the technical university, because at technical universities you will find the opposite that students need more practical work.)

- Express more clearly the level of knowledge which is necessary to start at a certain course.

It is surprising that Loes Marinussen's paper is the only paper analyzing recruitment activities. Why? Are we not recruiting anylonger?

We have had some success during the last 20 years recruiting women into science and technology. The number of women has grown. But still, women are not entering the hard sciences - or the hard engineering branches. At this conference we have faced new barriers in the area of computer science and construction.

So this brings the question of GASAT aims? What are the aims? Do we have enough women in science and technology? Do we want women to enter the hard sciences and engineering branches?? - instead

of that women are making new gender divisions at the labour market?

If we still want to increase the number of women in higher education we need both more knowledge on the barriers and the recruitment activities and strategies. We need to publish research results e.g. to pupils in upper secondary school. We need more research, especially on the more specific barriers to the different science and technology subjects. We need comparative studies. We need new and good examples of recruitment activities.

We need visions. We need good examples of another science or technology - a science and technology which have not been developed because of economical and profitable considerations.

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FRAME 2, PART 2

By Hanne Kock, Denmark

Anette has reviewed the barriers of entering science and technology courses in higher education.

Well, figures are climbing. Over the last twenty years there has been an increase in the number of women entering the technical professions. Some branches more than others. The differences in increase relates to social and cultural images of the countries (and not biology I believe).

But now that so many women have crossed the barriers, what has happened in the education? Have changes ocurred?

In the following I will talk about engineering, using it as a synonym for all scientific and technical educations.

So, does it make any difference whether we teach men or women? Are the women being welcomed? Do they feel at ease?

I believe that being a woman should be fun, even if you are an engineering student. Do the student-women have fun, if not, what can we do?

To be specific: do we in GASAT have any worries about the "new" women in engineering (new because now ordinary women have started entering). If so, what are our concerns?

Let us get inspired by the papers and see what they (and I) have to say on 1) the curriculum, 2) the teacher, 3) the teaching style, 4) the notion of critical mass and 5) a strategy for change, (let's call it a rule of thumb.)

The Curriculum

First of all, it seems, from looking at the papers, that the female students are satisfied with the curriculum, that is, curriculum in the narrow sense. This is very important since the subject matter is a very important part of higher education.

Karin Overdijk, the Netherlands, has made a survey of female and male students, of the Eindhoven University of Technology. The students were interviewed about experiences and behaviour in relation to the study and study-environment. Women and men showed only little difference on the curriculum factor.

Anette Kolmos, Denmark, finds no gender differences in opinion on curricula either.

Personally, I am not satisfied with these answers, or rather, I am not satisfied with the questions asked. As a teacher, I must remind you all, that we teach far more than the subject matter in our lessons and this "far more" I see as the real curriculum problem. (I will say more about this later.)

Some women though are not quite satisfied. Loes Marinussen, The Netherlands, does find in her research that female students find two, actually three things missing in their engineering curriculum:

1. Information on prospective job levels and promotion prospects.
2. Care for personal development of students in order to prepare them for a supervisory position.
3. Social aspects of technology.

This was mentioned by the women as missing. A course could be made on "the role of the engineer". But one has to be careful. If special courses are preferred by women, these courses may soon be considered second-class courses.

The Teacher

Secondly, let's have a look at the teacher. What do students think of their teacher? Is there a gender difference here?

Loes Marinussen and Karin Overdijk both report on gender differences in interaction with teachers. The female students often complain and I quote: "The teachers do not take me seriously."

These female students are suffering, because their male teachers still are at stage 1 on the teacher development ladder. (Do you know the stages of teacher development? It describes the teachers attitude towards girls in maledominated educations.)

Teacher development

Stage 1:	"Girls have nothing to do here. Girls are not fit for technical studies."
Stage 2:	"It's OK having girls here, but they should not have any special attention." (Translation: Nothing will be changed just because of female students. The girls will have to adjust.)
Stage 3:	"We must develop a pedagogy, so that men and women can profit equally from our teaching."

These stages are quoted from the Nordic BRYT-project. (BRYT-NYT November 1989.)

The Teaching Style

This brings me to the importance of teaching style. One might think, that in higher education the subject is more important than the teacher. After all, the students are grown-up people already motivated for the subject and the subject-matter is well-defined in the curriculum: The curriculum includes science and technology subjects and communication skills. Even languages are now accepted as relevant.

But to cope with an engineering job many personal qualities are needed, such as flexibility and adaptivity to different roles and future development, intergration of skills, cooperation, ability to specialize etc.

These qualities cannot be pinned down and analyzed in a curriculum. The development of these qualities depends on the organisation of stydy and the teaching style as Pauline Perry pointed out yesterday.

It's not so much a question of what you teach but how you teach.

In traditional higher education what you should teach is discussed a lot but how you teach is a personal matter and not very much looked into.

Teachers and students should consciously give priority to:

responsibility for own learning	rather than	teacher dependancy
active questioning	rather than	passive learning
critical, relativist thinking	rather than	right/wrong
the use of open instructions and conclusions	rather than	exact instructions and conclusions
problem – theory – insight	rather than	theory – problem – test
context justification	rather than	skills in isolation
teamwork	rather than	competitiveness
responsibility for product, customerservice and environment	rather than	having to "clean up" afterwards

(The list is inspired by Jan Hardings talk in Copenhagen March 1989.)

This kind of teaching emphasizes the process of teaching rather than the product and gives room for different student personalities. I believe that both male and female students would profit from this.

In our papers today, teaching style is mentioned briefly by Loes Marinussen. The female students criticize the didactic qualities of their teachers, (but not very loudly it seems.)

Mette Vedelsby, Denmark is at the moment doing research on the structure and teaching style in technical universities. She believes that structure and teaching style may be the most essential factors concerning drop–out ates.

The Notion of Critical Mass

Now I want to comment on the notion of critical mass, (described by Drude Dahlerup in "Vi har ventet lange nok", Köpenhavn 1988).

In politics it is often stated that there is a critical mass or quantity of 30 %. If a minority crosses this border, the minority (in our case the women) can succeed in changing organisational practices. This theory also applies to f ex ethnic minorities.

Being a very small minority f ex one or two women per class, you have some typical

Minority problems

- you are perceived as representing all women, especially if you make mistakes
- you become very visible
- stereotyping (women are either effective and cold or warm and a little bit stupid)
- role conflicts (being either a masculine woman of superfeminine)
- being excluded from the informal networking
- missing allies

According to the theory it is also very important whether the minority is minor or major f ex 10 % against 30 %. This is an interesting point in our current situation. But what difference does it make?

Maria Carme Alemany, Spain asks the question: "What happens in University schools of Technology, when women gain ground?" In Spain the percentage rose from 2,3 % to 14,1 % over a four year period (1981 – 1985). The result of the research shows that there is no automatic reduction of genderdifferences. On the contrary, the conflicts get more acute, because of the continued masculine domination. Women are still not given status of equal worthiness.

But, there is still hope for change. According to the theory there will be

Changes at 35 %

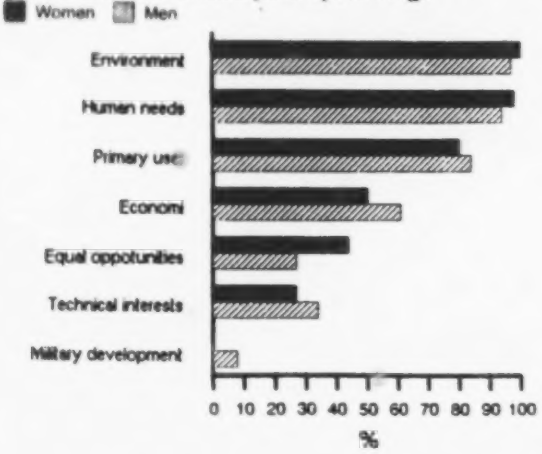
- stereotyping will diminish, it will not disappear completely
- there will be new role models for girls and women
- the open resistance towards engineer–women in the labour market will disappear
- only elderly people will not trust the technological decisionmaking of engineer–women
- female values are accepted as appropriate and natural

Maybe it also works the other way around, namely, working on the issues may raise the percentage of women in engineering.

Of course, all these changes don't happen at once, but gradually. And things are changing, even engineering attitudes.

An example is given in Anette Kolmos paper

Answers to the question: Which of the following considerations ought to determine the development of technology?



As you see, there is no difference between men's and women's approach to technology nowadays. Let us hope these students keep up their visions later on in their jobs.

Their jobs, -- this brings us to Frame 3: Women working. This is a theme we in engineering education need to know more about. Are the engineering-women getting jobs? What kind of jobs? How do they cope with family/job? Is it true, that after five years in engineering they quit, and become teachers, councelors, advisors?

Anyone interested in these questions should read: Ruth Carter and Gill Kirkup's "Women in Engineering, A Good Place To Be?" Macmillan 1990. The overall frightening question is: Should we be encouraging more women to become engineers? Or, is the price they pay too high?

I find the book inspiring, constructive and down to earth. Read it, and recommend it to teachers in engineering education.

A Strategy of change

What strategies do we have for change?

We must use the opportunities we have for discussion, now and when we get home.

Accelerating changes in industry and society implies that engineers of tomorrow will need new qualifications, some of these could be female. In Denmark we have a discussion going on at the moment concerning quality in education, from primary school to university level. This is a perfect opportunity for us teacher-women to add new values into the teaching of technology. Female values, of course. We must enter the discussions and give ideas on how to change the traditional curriculum and traditional teaching style of the engineering educations. But how do we do it without being turned down? The method I find works the best, (but you may have a different view,) is to discuss curriculum and teaching style without saying that I am doing anything feminist ... as if my ideas are simply (which they are) part of received wisdom on the subject.

So my advice is: enter the discussions, but don't label your opinions and ideas feminist.

Another interesting debate going on in engineering circles is on technology and ethics. It is interesting to note that questions on technology and ethics are being reconsidered on both sides of the Atlantic at the same time. Both terms technology and ethics are originally Greek, "technos" relates to art and craft, "ethos" originally means habit or convention. Nowadays we may say

- technology denotes what we can do and how we do it
- ethics is concerned with whether we do it or not.

Both concepts are man-made (..?..), neither universal nor invariable. There are great variations according to location and culture, and great changes occur over the years.

Here again, we should enter the discussions and make visible our points of view.

But, (and now I come to the final point) we need research.

We need research on, let us call it, appropriate values.

As Maria Carme Alemany points out. We must produce critical analysis of the male-centered values carried by science and technology. We must formulate a critique of the way schools of technology operate as domains where masculine values still rule.

To do this we must deconstruct the figurative ideas we have of science and technology, and the university organisations. Really, we must go as far back as to the Middle Ages of Western Culture to pick up the lost female threads that were common then. (And my final, final point):

We as science-women cannot do this by ourselves. We need help from philosophy, anthropology, sociology etc. And we need help from both men and women.

Frame 2 Part 3

Teacher education

Ilja Mottier

A second series of papers deals with teacher education. There are two sides to teacher education: from the one side, it prepares teachers for primary and secondary education, from the other side it is part, itself, of higher education. The different levels have their own management tradition: primary education is often ruled more centrally, whereas institutes for higher education have- and maintain- their own autonomy. This may lead to opposite strategies, thus preventing the teacher training institute to act as an example, a role model, for future teachers.

Let us first look at the role of teacher training institutes in the initial teacher training, the pre-service training, the training of the future teachers, of science and technology teachers in particular.
Lesley Parker and Leonie Rennie from Australia argue that teacher training colleges should not only train, but educate ("bilden", the Germans would say) future teachers in such a way that they, above all, care for children. Teaching requires care, concern and connection. - Features especially ascribed to women.
The public debate is going in the other direction. Public opinion shows a concern for
a. The quality of education.
This goes together with complaints about the "feminization" of the teaching profession. As if the mere fact that women are working in a certain profession would diminish its quality.
b. The shortage of teachers in specific fields, especially in science and technology.

The remedy sought here is: increase the salary in order to attract those people who now decide to go into industry.

In the light of Rennie's and Parker's arguments, both strategies neglect the care, concern and connection, neglect what really is the heart of education, that is caring for (young) people.

Now, how would the pre-service training of science and technology teachers look like in an institute which trains teachers to be these caring persons. And: how would that institute itself look like.
It would have as its policy to be a home for a great variety of people. People with different backgrounds, of different culture, colour, sex. sexual orientation, etc. The curriculum would be multi-cultural. Great attention would be paid to the ability of the teachers to deliver a teaching geared to the needs of all students.

This model of institutional policy would be presented to the students, so that they would learn to develop a non-sexist, non-racist attitude, caring for everyone's needs. Their attitude would be formed.
At the micro-level, they have to learn about good teaching practice, not letting dominate one group over the other, paying equal attention; not allowing themselves to be influenced by stereotyped expectations; they demand equal performance of all pupils. They would also acquire concrete knowledge to put into the curriculum.

They would also learn something about the meso-level, about policy-making at the school level: how to make an equal opportunities or positive action plan in the school. How to organize it, how to develop strategies; how to seek allies in the school, how to overcome resistance.

Science teachers
What should the future science teachers learn?

They can learn about the role of women scientists (We see an example of this in the paper of Sylvia Benckert and Else-Marie Staberg from Sweden). They can learn how to bring female role models in the class.
Or they would learn what the interests of girls are, so that they will know how to find examples for their lessons in the interest spheres of boys and girls.
They learn to organize their practical work in the class in such a way that girls get equal exposure to practical activities (and not only do the writing).

Technology teachers
Many of the things that have been said for the science teachers, are also valid for the technology teachers. But for them, it is especially relevant to develop, what Hanne Kock from Denmark in her paper calls: a humane technology.
That is a decent and dignified use of technical knowledge.
Technology assessment is an integrated part of this concept.
It has to be used at an early stage of problem solving, in realizing that "prevention is better than cure". And may be the solution to a problem may be not to use technology at all.

Staff development
We have been looking until now at what should be taught to future teachers. But we must not forget the teachers of the teachers: we should do something about staff development.
They need to be informed first about all these developments in the thinking about science and technology for all.
And they, like the future teachers, have to work on personal development. Hanne Kock describes some elements. It means for the men: build up their "we" attitude (a sense of collective responsibility). It means for the women: strengthen their "I" attitude (self-respect and self-confidence).

These are some of the things that can be done in pre-service training.

In-service training

Most of the contributions focus on in-service training, that means working with already practising teachers. We want these teachers to change their attitude. Many projects work on this. But do they use the right methods. Have they given enough thought to innovation strategies?

Leonie Rennie and Lesley Parker give much thought to the innovation strategy. Many projects just work at the cognitive level. They give teachers information, and expect teachers to change accordingly. For example: they give information about the small number of young women in technical universities. They give physics teachers the arguments why this should be changed, and then expect these teachers to counsel and guide their students into physics.

But this strategy only works with people who are already convinced, and who only needed that last bit of information. If you want to get other teachers on your side, those who do not share your convictions, you have to use another strategy. This will be more of a negotiating process, where you bring some arguments in, and where you then come to a conclusion.

It is an ongoing process. The teachers must have the opportunity to discuss new ideas, they must try out the new materials and be able to evaluate them.

When we help teachers in developing an innovation, this very often takes place at the demand of the teachers themselves. It is then relatively easy: the teachers phrase their needs themselves.

Equality issues are a somewhat different innovation: they often do not follow on needs expressed by the teachers. They are set in motion because of needs expressed elsewhere. For example by the authorities, who are worried about the future shortage of scientists. Or because they want to implement an equal opportunities policy. Or the initiative comes from (feminist) researchers.

The initiative for innovation does not come from the teachers themselves. Nevertheless they are charged with the

realization of the innovation. This forces us even more strongly to reflect on our own innovation strategy. To go smoothly, to be willing to negotiate, to work not only at the cognitive level, but also at the attitudes.

And then, if we take into account all these conditions, what can we do then? We can develop projects, and materials, such as the ones described in some of the papers.

Women scientists

Sylvia Benckert and Else-Marie Staberg from Sweden set up a project which originated from a textbook analysis, which showed that no female scientists were portrayed.

Benckert and Staberg therefore decided to picture some women scientists. They addressed not in the first place the students in secondary schools, but the student teachers. Their idea behind this was that it is most efficient that future teachers be confronted with information on women scientists, so that they can tell about them in their classes.

They chose six women scientists, tell their lives and draw some general conclusions. It would be interesting in this respect to also pay attention to how (some) women do research: the example of Barbara McClintock could be cited here.

All the women depicted are non-Swedish women (though one, Lise Meitner, lived some time in Sweden). It would be an important step to retrace the Swedish history. This will bring the subject even closer to home for the students. This will be the next phase in this project.

Science in primary education

Two papers deal with in-service training for primary teachers.

In dealing with the papers in the framework on primary and secondary education, the importance was already discussed of starting with science and technology at an early age.

We are then dealing with primary teachers who did not get any training in these subjects themselves. And they are women, in most of the countries. In practically all countries in the world, teaching young children is a female job. The women who have received the kind of teacher training for this job have one thing in common: they went through non-science branches. Neither was much science and technology training included in their pre-service teacher training programme. At least as far as the countries in Western Europe and in Anglo-Saxon cultures are concerned.

We get a very interesting account on training primary teachers for science from Australia, in the paper of Margaret Bearlin.
They have taken into account the fact that they are dealing with women, and have given much thought to the teachers' own feelings, to their selfconfidence and feeling of personal power. The idea behind it is not only to make women more confident in science, but also to make them value what women can do. Then these teachers will in turn value the things their own female pupils do.

Technology in primary education
Technology is considered to be more and more important in education. Not only in vocational education, but also in general education.
It is important to start this technology education with children at an early age. Research in the Netherlands has shown that the attitude of very young children towards technology is still open. After age 10-12, it becomes more negative, if children do not get a good idea of what technology is about.

It is therefore important to teach technology to young children, and to train the teachers of these children. Anne-Marie Israelsson and Lennart Nordell report on the Teknikens Hus in Lulea. Here they have gained a tremendous experience in doing so, because they have by now trained more than 1200

pre-school teachers. They are thus able to communicate a lot of experience.

Among the many good things in their training programme, we find the broad approach of technology and the attention for gender issues.

Technology is seen in its broad context. Not only machines, but appliances for daily use in the home. The theoretical approach makes us realize what technology is: not only the art of using tools, but a general approach of solving problems to meet the needs of human beings in every day life.

This approach is also used in the Netherlands, where there is a group Bastec (basic technology) with the same intentions as the Teknikens Hus. Bastec has made three videofilms about technology teaching for young children, and is now preparing in-service training of teachers. But it has not yet gained the experience of the Swedes. It would be interesting for many countries, to see more of the Swedish materials.

Internationalization

And then there is the issue of internationalization . My own paper is dealing with it.

We organize international conferences, and hope to learn from each other. We start cooperation in international projects, and hope to develop things together. But: what can we learn from others? We have to interrogate ourselves about the role of the social or national context in our work.

For example: when Maria Carmen Alemany writes about gender relations in Spain, what is determined by the Southern-european region she lives in, and what can be transfered.

Can research results on interaction, obtained in the United States, where women learn to speak out more than elsewhere-be used in the Dutch schools?

Can the strategies of Nancy Kreinberg's Equals project with the parents be used in countries where they are not so used to work with parents?

We can ask ourselves the same question about one of our central topics of today: attracting more girls in science and technology. Whereas on the one hand the underrepresentation of women is universal, on the other hand, many of the strategies depend on the national context.
For example: in the Netherlands there is an option system where girls can opt out of science. It is then important to stress on guidance and counselling, in order to inform girls about future careers and to convince them to take up subjects like mathematics and physics. If there is no option system, this strategy is far less relevant.

Wishes for the future

You are invited to reflect on wishes for the future yourself, in the discussion groups. You are certainly able to come up with many ideas. To stimulate your discussion, we will just come up with three suggestions, in different fields.

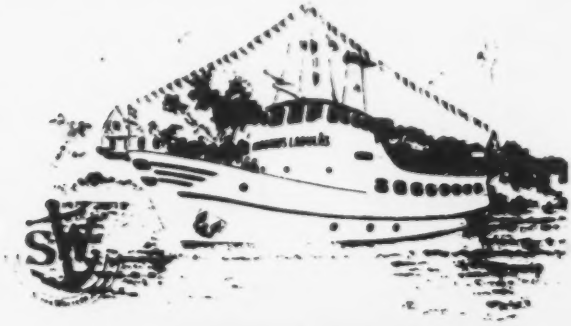
Research:
comparative international research.
We have to look closely at what is done elsewhere, analyse the factors of success and failure, and then see what we can use of it in our own context.

Training:
more equal opportunities in pre-service teacher training and in the training of the staff.

Policy:
get equal opportunities in the mainstream debate.
This means: follow the general educational debate and see where you can incorporate your views right from the start, from the conception of the idea, so that you are not always running behind.

For example: if committees are set up to make a national curriculum, get your ideas in (and get you and your colleagues in the committees).

Many countries are now having a debate on quality of education. Institutes for higher education will have to conduct their own quality assessment.
Get the idea through: quality = equality.
There can be no quality without equality. When criteria are being made for the quality assessment, get equal opportunities criteria into the list.
In brief: if we think more about strategies, we do not always have to run behind any more.



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FRAME 3

Part one

Women in the workplace

Women in Engineering and Science Careers

By Christina Ullenius

This is a summary of Christina's presentation.
List of submitted papers:

Asenath Sigot, Kenya
Regina Papa, India
Anne Walton, England
Chandralekha Raghuwanshi, India
Maria Carme Alemany, Spain
Abdulrahman Attiyat, Jordan

How are the women doing in Sweden?
Statistics:

Swedish facts of life; Women in 4 1/2 year study programs

Chemical Engineering	47 %
Civil Engineering	23 %
Mechanical Engineering	12 %
Industrial Engineering & Management	21 %
Electrical Engineering	9 %
Computer Engineering	8 %

Completing studies successfully ⟹

13 % of all engineers under age 35 are WOMEN!
(82 % of the Swedish women are employed)

How are the women engineers and scientists doing careerwise?

Access to jobs?
Career development?
Well being?

Anne Walton's paper:

- A career as an inorganic chemistry
- Turned to life histories
- Women in science
- Nine successful women

Study: Are there any common factors in their background to explain their career choice?
No clear pattern

However: Several similarities in their experience as scientists.

- Low aspirations
- Lack of confidence, academically, socially
- Feeling of invisibility
- Family – career conflicts

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Women in the workplace

Women in Engineering and Science Careers
How are they doing?
Should we encourage girls and women to go into Technology and Science?

Barriers:

The barriers to equality are general and pervasive:

- Outmoded attitudes about the role of women
- Direct or indirect discrimination of women
- Inflexible structures for work and careers
- Childcare
- Dual career families

First question and answer:
Should we encourage girls and women to go into Science and Technology?

Yes, B U T....
Requires major societal changes. Changes in the organisation of work.

One of GASAT's objectives:

- To facilitate the entry of women into employment in the fields of Science and Technology, and their progress within such employment.

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FRAME 3

Part two

By Christina Chaib

Main differences between the developed and the developing countries.

I will focus three general factors that are important for many of the developing countries – without generalizing.

I There is a historical aspect because of the colonialisation epoque. It has influenced the development in the whole society badly and of course in the education system as well.

II An economic aspect is that the economic level in these countries is low. The problem, is connected to colonialism and the period that followed in many countries,neocolonialism.

Many third world governments now earmark up to one third of their annual budget for paying off foreign debts. The basic economic barometer, GNP per capita, has remained static in many parts of the Third World, or fallen in the case of Africa, over the past decade.

Because of the economic crisis, the share of all government spending allocated for education in the poorest countries has fallen from 16 to 12 % since 1970 (World Bank 1987, 1988).

III A third aspect is the demografic one.

Since World War II, Third World political leaders and international agencies have counted heavily on the rapid construction of schools, believing that strong social and economic benefits would "pay off". In the 1950's,

governments reported that one third of the children were enrolled in primary school. Today this rate exceeds 70 %. Almost 800 million youngsters will be attending Third World schools by the year 2000 (UNESCO 1983). With child populations doubling every 20 – 30 years, Third World leaders feel enormous political pressure to maintain this breakneck pace of school expansion.

What can we, as scientists and researchers in different fields do to find a solution to this situation?

The contributions here from the Third World participants, both papers, lectures and discussions give us a good insight of their situation in these countries.

I will mention three school related variables common in these countries, predictive for how to achieve school success.

1. **DROP-OUTS - REPEATERS**

Regina Papa	India
Chandralekha Raghuwanshi	India

Both papers tell about the drop-outs:

- more girls than boys
- more from rural areas than urban
- more from strict severe home conditions than from more liberal ones.

Since there are not enough education possibilities in higher education, many countries in the Third World applicate strict competition systems and very rigid examinations.

2. SOCIO-CULTURAL ASPECTS PARENTAL INFLUENCE

Asenath Sigot	Kenya
Juliana Amara	Sierra Leone
Abdulrahman Attiyat	Jordan
Shadia Tel	Jordan
Chandralekha Raghuwanshi	India
Silvia Chavarria	Costa Rica
Radha Chakravarthy	India
Regina Papa	India

Many of the papers mention the social cultural aspects as constraints for the development. There is often a very strong male dominance and the girls are early prepared for the marriage and for a life as a wife and a mother.

Even the parental attitudes, family background, play a central role for specially the girls opportunities to get an education, make a career as well as leaving school and start to work at an early age.

3. THE LOW COST EDUCATION

Tortiv Ato	Nigeria
Juliana Amara	Sierra Leone

The school costs are always very low and there is a lack of materials such as textbooks, desks and even classrooms. It is not unusual that pupils have to go to school late in the afternoon. They have to wait for an empty classroom.

A researcher named Correa said in 1964 "The quality of the product of education is more a result of socio-economic factors outside the educational system than of the inputs in the educational system itself."

Many agree with him and we can see it in the papers too.

We can't improve the school quality by simply spending more money. Researchers are working with the effectiveness of different school factors as:

- Single-sex school and mixed school
- Textbooks and other materials
- The teacher training programmes
- Pupils feeding programmes
- Reducing class size
- Science laboratories
- Teachers salaries
- Pupil repetition

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THE "THIRD WORLD" PANEL

We had called the conference "European and Third World GASAT Conference" and it was good to see that 13 representatives of the latter group had been enabled to come to Sweden. We wanted to make the most of their presence and saw that one way to do this was to ask them to form a Panel to which other participants could submit questions. Such a panel formed part of the programme on the third full day of the conference.

Karin Söder (member of the Swedish Parliament) chaired the Panel Session.

Speech at the GASAT conference,Jönköping 9/5-90
Karin Söder,member of the Swedish parliament.

Our world is created and built by women but dominated by men. To day we are going to discuss science concerning women of the third world.

Let me start with a statement - Women-oriented science has low priority all over the world - in my country, in the rest of the developed countries as well as in the third world.Our problems have many similarities. IT takes time to reach equality.

In general Social science is of a lower priority than for example medical and technological science- all over the world. The main problem for us is the fact that the areas where we may find the backgrounds and thereby the explanations of the sitution of women today - in the developed as well as the developing countries - probably are in the field of social science.

Of course technological and medical progresses are of importance for the women of the world. When however these achievements don't reach the women, or influence their situation,it will not lead to any progress of importance for the future.

Farming is one of the most important tasks for the women in the third world. Modern technology and new methods in farming is often introduced regardless of the social and cultural effects they will cause women and children.

New effective methods concerning healthcare are of little importance for the women and their children if we don't consider the special need for knowledge the use of new methods demands in order to be a positiv contribution,when applied on their own environment.
Progress in social science - to achieve basic knowledge of the mechanism for discrimination and repression of the women in the world - That is a goal to strive at. The main question is how ?

Women-oriented science - mostly performed by female sciencists - need resources. Money is of course important but is not the main limiting factor. Important work has already been done by skillfull scientists. The implementations of this results however are depending of political readiness to change social structures - to change the very backbone of a society. This is a painfull and slow process.

With the complexity of the role of women in the whole scientific world cooperation is necessary.
The formation of network where women strive together towards a common goal is in my opinion essential. In the political life, in the everyday life as well as in science, women have to be united to gain strength and thereby increase the force of their demands.

Forming female networks amongst scientists should be of highest priority. Network where scientists working in a broad field get together to strive towards the goal - maintain a higher degree of equality politicaly, socialy and economicaly for the women in the developing countries.

To alleviate the burden of the women in the third world, education is essential. Educational programs for a basic knowledge about health, familyplanning, skills for agriculture and non-farm enterprises as well as understanding for civics are vital for progress. How is that done?

Recently two female scientists in Sweden put forward a study of law and women. In the Statue book of Sweden discrimination of any kind of any person related to sex is prohibited. In spite of this the two scientists found that swedish laws in many aspects are discriminating the swedish women - because they make allowances for the demands of men,without consideration of the special needs of the women.

Regarding the legislative processes in most countries I claim that laws and other official regulations often are drawn up in a similar way as in Sweden by men and for men. Special projekts to analyse and bring into light the - often unintentional -

discrimination of women are important in many ways. When it concerns this type of discrimination it is of the greatest importance to initiate a discussion amongst those who finally has the power to take the decisions.

Womens professional work is limited to a few areas. The responsibility of farming and foodproduction as well as caring for the family as a whole and nursing the children are by tradition the labour for women.
Historically this was the situation in all our countries and it is a reality in many countries today. To gain economically independence the vocational training for women must be intensified,so that they can be involved in new areas of professions.They also have to be payed according to their contribution to the economic life,for which they are carrying the heaviest burden.This is a necessity for all those women living in urban areas. Their future is dependent on success in this field.
In the rural areas you can apply the same attitude,but it is of the greatest importance to appreciate and take care of the experiences and skills the women have and from their status develope their situation.
To develope the rural areas is also to avoid the refuge to the slum areas.
The progress of the society is dependent on the possibilities the women will get.
The children are dependent on a decent life for their mothers. This is more and more obvious taking into account that in the coming ten years 1,5 billion children will be born,most of them in the the developing countries.

It is a challenge for the researchers in the technological field as well as in other fields to find a way,always to consider which type of technology is the most efficient in the daily life for women in a developing country.
In the same time it is essential also in highschools and universities to learn from and listen to these wonderful and courageous women,who know so much of how to survive during the most difficult circumstancies.

Finaly -we have a great responsibility in our part of the world

for our sisters and daughters,who are not so previliged as we are.But we also feel,that we have a lot in common,that we have much to learn from each other.WE DO HOPE that during these days we will find,in what ways we can cooperate.Can our experiances be useful to you and yours to us.How do we create a network through which we can contribute to a better future for our small world we have in common.

BEST COPY AVAILABLE

In the time available for the Panel session only some of the submitted questions were considered. Many questions were put forward – a measure of the interest and concern that participants felt for women and girls in Third World countries.

It was apparent at many points in the programme that we were not happy with the nomenclature available to us. "Third World" and "under-developed countries" were patronizing: "developing countries" was perhaps a little better. To compensate we sometimes referred to "Western-style" countries as "over-developed".

Karin Söder started the debate by introducing the panel and summarizing the questions:

Karin Söder:

"We have Elvyn Jones-Dube from Botswana, Silvia Chavarria from Costa Rica, Farag Moussa from Switzerland but representing Egypt, Chandralekha Raghuwanshi from India, Shadia Tel from Jordan, Asenath Sigot from Kenya, Stella Williams from Nigeria and Juliana Amara from Sierra Leone.

When trying to organise these questions we found that they are representing three different groups, a lot of questions about the gap between the developing and the developed countries, the gap in many areas; economically, scientifically, the role for women a s o. There are many questions about how we in our part of the world can support the developing countries without failing.

We are fully aware of that we have to learn a lot from you in order not to make mistakes and everything has to be done in cooperation. From my point

of view I think that we have established too many big plants and factories without finding a way to start from the level for everybody to just "lift" them up to a level they choose themselves. This is the first group of questions. The second one is the women in science and career, the differences and how can we support eachother and what can we do.

The third group is the importance for the womens' situation for the religion, the culture, the traditions."

What follows here are extracts from the discussion. The participants from "developing countries" who did not actually sit on the panel also had the possibility to answer any of the questions.

Questions about how we in the "developed world" could work most effectively together with women from the "developing countries" gave many answers from the panel.

Asenath Sigot:

> "One way we can work together would be for those of us who are working with institutions, we can link up with other institutions in developed countries.
>
> Let me give you one example of a home economics institution in Canada because I had the privilige of visiting them last year. They have what they call a twinning project, where they twin an organisation in Canada with one in Africa. So far they've been very successful because the organizations are developing textbooks for schools."

Stella Williams:

"Mme. is also adding to what Asenath from Kenya said about what can be done in terms of international organisations and developing countries.

My suggestion – and we've been dialoging on this with our friends during various networking – is that a collaborative work could be done between people. For example here at GASAT we've been discussing various issues, curriculum, approaches, methodology, attitudes. If international organisations can begin to work with various networks and give the money to these networks to get collaborators to look at these issues, and test some of these things, we could work on that international basis."

Juliana Amara:

"I think the reason why we have been set aside on this panel as Third World people is not just for us to expose how bad we are. How difficult things are with us, how poor we are. But I think there is a more positive motive for setting us aside as Third World people and I'm happy about the first question that was asked – how can we work with you. I was very happy to hear that question because that eases my mind that we are not just here to expose how bad we are. We are working with people who are our friends, who are interested in our problems and are willing to help."

Silvia Chavarria:

"I think knowledge ought to be applied between developing and developed countries. You just can't translate what the researcher is doing, you have to act as facilitators, so that we can construct our own knowledge. The aspects you're using in your own classrooms are to be translated to our countries too."

Chandralekha Raghuwanshi:

"The question is: The various agencies which are working in developed countries, are they interested in working in India?

Jayshree Mehta has been working in this field quite a long time, and she has also visited a vast number of countries in the world and has a lot of experience of interacting with the world community. She has also worked in the rural areas of India so I think she could answer this question."

Jayshree Metha:

"The things that we really would be very careful with is the model of giver and taker. We are really going to work at an equal level where you are going to learn from our situations and we are going to learn from your experiences."

Shadia Tel:

first gave us some statistics on how many girls who are studying scientific subjects in different countries and compared the figures from Western Germany, USA, Holland and Norway with those from Jordan. She then asked the question:

> "The question is who or which country is the underdeveloped or the developed?"

Juliana Amara:

brought up the fact that a great portion of the so called help from the Western World goes back to the giver.

> "You give aid with your left hand and take it away with your right. OK? A large percentage of what is given as aid goes back to the giver in so many forms..."

Several people on the panel pointed to the difficulties in educational matters concerning girls in developing countries, since there is a lack of basic needs.

Juliana Amara:

> "When a human being lacks the basic necessity and the basic needs are not satisfied, then all other needs are difficult to meet."

"When we talk about women into science and technology, it's an educational issue that involves these people, teachers and parents together. Now, you talk to teachers about having educational innovation in the schools and half of the time or most of the time the teachers are worrying about these basic needs. They are not so interested in these extra activities that are coming in."

Elvyn Jones-Dube:

"Governments are not able to provide everything that the individual citizen needs and much of that is basic amenities."

"One of the mayor problems that Third World women have is money. We don't have money. We need money. We are 50 % of the world population but we have something like 10 % of the money. Another area that women want access to is management skills. I think very many women have seen the need for their ability to produce their own income. We have a growing proportion of women in the Third World who maintain single-parent household because the men have left."

Chandralekha Raghuwanshi:

"Our own scientists who are living and working in the laboratories should come out of their laboratories. They realize the problems of their own countrywomen and girls and they find out the needs and they should work for those. It would be better for the scientist of the same country to come out from the laboratories and work for the problems for their country."

She also pointed to the "gap between developed and developing countries".

> "There are so many problems with developing countries. These problems also reflect for the drop–out for the various levels in the school of the girls and women. These drop–outs may be due to social cultural problems. There are also several difficulties and problems in the examination systems and with the curriculum which is ment for the girls a s o. The teacher education and teacher programmes also include problems. But, the gap can be reduced and we always will welcome the other agencies from outside which can come to India and want to work with these things."

Stella Williams:

mentioned that women in Nigeria used to hold a very strong position...

> "In the part of Africa, at least where I come from, women used to be the leaders and women used to control the men. And our grandmothers and mothers still have the teqnique, they still have the strategy with which to cope with the men."
> "In a number of other developing countries women have been carrying out natural sciences for centuries and we've never sat down and actually analyzed those basic information that were there. One very good one is the use of honey for medicine. The other one is the use of herbs. One could go on and on. For instance you'd find that the average African woman really has natural ways of birth control". "But we failed to document these informations and gradually we've lost them. I'm hoping that part of GASAT in the next decade will be able to find some of this science and actually make them live again."

Juliana Amara:

said that "sciences are universal". We must understand the language of science. Books are "history" and contain far too little practical knowledge. The great lack of materials is a big problem.

Farag Moussa:

cautioned us not to rely to heavily on comparing statistics concerning women and studies in science and technology in different countries. Role models are important. He mentioned some women inventors who have made major inventions in different areas. (For more information, see the description of Farag Moussa's poster paper.)

Elvyn Jones-Dube:

brought up the issue of South Africa

> "I would like to caution everyone that the South African question has not been resolved and we should not unconsciously or consciously try to push the subject out because of what we see happening. Nothing has happened besides talks about talks. Apartheid is still very much in place and if you were to travel to Cape Town or Johannesburg today, you would see that. So the South African question is still very hot and I would be delighted that the question could get the attention that it deserves."

FRAME 4 PRESENTATION

Frame 4 contains papers which did not fit really into the three "call for papers" frames, but taken together, provide a connected account of feminist analyses and action.

The presentation takes the following form:

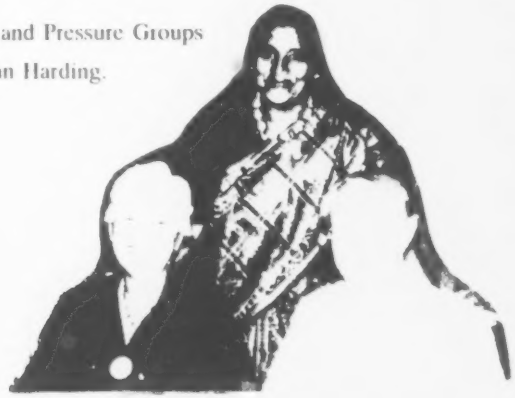
FEMINIST ANALYSES

- Feminist inspiration to a better world
  Presenter: Saskia Everts.

- Medical technology and female identity
  Presenter: Anne Walton

ORGANISING FOR CHANGE

- Networking and Pressure Groups
  Presenter: Jan Harding.



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Frame 4, Part 1

Feminist inspiration to a better world

Summary of the First Part of the Plenary Introduction to Frame Four

Saskia Everts

We are all here to change science. But in which direction? Do we want anything that's most effective for getting girls in? Or do we also use a second criterium: that it should also lead to a 'better' world. Or, to put it differently: do we want half of whatever world we can get half of, or do we, in the process, want to take care of what kind of world we will get half of?
I think, looking around at this conference, that there is rather much consensus about this: we also want to consider the second issue. We also want a better world, in more senses than equality for men and women. This means that we are really dealing with two issues. We want women in, and we want a better science (in the sense of leading to a better world for men and women).
The question is now: are these two issues related? That is, does the second one have to do with gender in any way? Because if this is not so, then we cannot talk about changing science waving the word 'feminist', or 'as women'. Talks about a different science would not belong at this conference, but at one of the other conferences which center around the ethical reflection on science.

It seems intuitively right that the issue is dealt with at this conference, and implicitely it's there all the time. But why exactly? I want to address this question explicitely, because I would not like to combine the two issues for the wrong reasons. So: in which ways do women have a key to better science? What is this key exactly?

I see three possible 'keys'. Two of them would be easy, because they would not need explicit and extra thinking. But I don't believe in them. I will first describe those two.

Key 1: 'Changes in science that will cause more women to enter it will also make a better science.'
We're very used to thinking this way. I actually found it hard to think of examples of changes that would stimulate women that would *not* seem like improvements. But when we look at sectors of society where there has been more of a chance to make such changes, it's easier to see that there can be negative sides to those changes. For example in the social sciences: women liked research where they would not have to work with numbers and statistics, and thus stimulated the development of qualitative research. However, noone argues anymore that qualitative research is always better than quantitative research. There is a line there, beyond which we don't think we should go.

Key 2: 'If we get more women into science, slowly science will change for the better because of women's influence.

What is this idea founded upon? I will name two things: the belief that women's ways are better and the suppositions that 'women will always be women'.

-1- The belief that women's ways are better.

Yet here we are, working on changing the lives, opportunities, carreer paths and perspectives, choices outlooks, ambitions of women. Clearly we feel that only some of women's ways are better, otherwise we wouldn't need to change anything.

Thus I would like to introduce a distinction between those ways of women which we do like and want to retain, and those ways of women which we are not so happy with. For the kinds of things we like about our typical female ways I'd like to use the adjective **feminist**. They are not just female ways, no, we call them feminist ways of doing things because we are proud of them and feel they are better alternatives and want to retain them.

-2- The supposition that 'women will always be women'.

I find this suppositions *dangerous*, rather *improbable*, and luckily also *unnecessary*.

a. I call it *dangerous* because it seems to be founded on an essentialist conception of the differences between men and women. The female things are expected to be found among all women and in any woman. They are somehow, somewhere always a part of any woman, no matter what kind of situation she is in - even if she lives in the masculine world of technology. Maybe we need very sophisticated methodology to find this deep, somehow essential femaleness, but it's there.

Let me suggest another definition of the word female. If I use the word female I will mean **statistically female**. That refers to the average differences we may measure if we look at average groups of ordinary boys and girls or men and women. Such things are female in that society in which you found that measurement, and I would keep on calling them female for as long as the difference can be measured. This is a very neutral and empirical definition, which conceptualises 'female' as something that's not in some essential automatic and permanent way linked to that group of people that are called women. (Although it may for all practical purposes be very difficult to get rid of the statistical differences.)

The definition does not make a distinction between statistical differences that are biologically programmed, or those forced in by society, or a combination of the two. Such a distinction is not possible, because there is no biology without it being recognized by society. Society constructs biology, using some clues, ignoring others. The distinction also doesn't matter for the 'rightness' of statistical differences (biology can be very 'wrong'), nor for the changeability. (biology may be easier to change than society).

So this is what I will mean by statistically female. And this other thing (that I don't believe exists but still have to give a name so that I can talk about it) I will call '**somehow essentially female**'. I use the phrase 'somehow essentially' where one often finds 'biologically'. That is because I reject the idea of 'biological and therefore essential to women'. By using 'somehow', I put the burden on those who want to think in terms of essentially female qualities, to explain what kind of essentiality they mean, without resorting to biology.
Thus the hope that women's loving, caring attitudes will change technology somehow if only they enter it in large enough numbers, supposes that women's caring is so generally present for all women, so resistant to change, that, in spite of alle the changes that are required to get them into engineering, this quality will be unchanged for them - whichever particular group of women they happened to be. Then it must be that after all a woman will always be a woman.

b. Luckily, I think it is rather *improbable* that this is the case. Already most research results show that the women who are now in engineering are little different in attitudes from the men. And that's only attitudes. We know that in the step from attitude to behaviour, a lot of influence from things like structural conditions, possible alternatives, position of the actor, etc. come in, tending to lead to even more similarity.

c. *Unnecessary*: Is this upsetting and disheartening? Do we need more sophisticated research to show the differences between men and women engineers? And if we can't find them, does it mean we have lost the link between our concern with women and our concern with a better world for all humans? I don't think so because I don't see that our feminist right (and obligation) to think about a better, more humane world is hinged on this second 'key'. So I come to the third 'key'.

Key 3: Either female ways, or 'the feminine' are likely to be a good starting point for change for the better
With the conceptual category **feminine** I refer to the categorizatica people make in their heads of all kinds of phenomena (people, clothes, names, personality characteristics, jobs) into either masculine or feminine. I'm not quite sure whether the female or the feminine would be the best startingpoint for change. But since they are bound to overlap a great deal I will, until I have this more clear, use both concepts.
So why is either or both of them likely to be a good startingpoint for a better science? I worked this out in my article for this conference ('Social responsibility in technology and feminist visions'), so I will here only shortly recall Simone de Beauvoir's characterisation of the feminine as the 'other', the non-dominant, less-valued, forgotten alternative. My claim is that in a society like ours, where there exists this enduring repression of one alternative, this alternative is bound to be a fruitful inspiration for change for the better.

Now if we take these concepts female and feminine as startingpoints for new visions, we do not need to look at the exceptional group of women already in engineering. We look rather at the average of women. If we want to find out about their statistically female ways, we will usually have to ask them about other contexts than engineering, because they don't know the engineering context. If we then want to use their ways as a startingpoint for change in engineering, we will have to make a translation to the engineering context. And finally, after all that, we still have to evaluate if this alternative is 'better'.
Surely then the female alternative cannot be more than a startingpoint. But, I think, a very vital and inspiring startingpoint.

Keller's analysis of McClintock's work formulated in these terms

To close off, I will very shortly look at one of the more revolutionary ways of integrating gender into the analysis of science, and see if I can understand how it works, using my terms. In the proces, I will indicate how such an analysis relates to the tradition of 'modern social studies of science', since this last tradition has not always been very understanding to gender analyses.
According to Evelyn Fox Keller, Barbara McClintock had a preference for an interactive theory for the working of genetic material, and rejected the simple, one-way hierachical model. Such an interactive model is in our culture sooner associated with the conceptual category of feminine than masculine, and probably also found more among women than among men, implies Keller (refering to psycho-analysis). Thus, in my terms, this methodological preference is both a female and feminine characteristic. And, since Keller argues that it's a very good model, it's not just feminine, but nice-feminine, or feminist.

Now Keller makes the point that there is a bias against this kind of theories. Thus this would be an example of the feminine as the undervalued, unaccepted, uncomfortable 'other'.
For Keller, this is an important part of the explanation of why McClintock's work had such a hard time getting accepted.
This kind of feminist analysis of scientific practice builds on modern social studies of science, but also redirects it in an important way. Modern social studies of science have described the human interaction involved in the construction of 'facts', 'valid' methodology, 'acceptable' deviance of measurements, 'good' science etc. They have shown that not 'nature' determines the final outcome of a scientific controversy, but people do. However, modern social studies of science have been so delighted by the discovery of this pluriform arena of debating, arguing, using all kinds of unpredictable strategies, allies, and rethorics in the social construction proces, that they have had little attention left for possible regularities which might, for certain periods or within certain circumstances, still influence the course of these these processes. I would argue that the idea that facts are human-made puts on us even more explicitely the burden

of asking: so why do certain theories or models or methodologies win? Because we see clearly around us not only diversity, but much similarity too. So there must be a certain regularity in the patterns which determine what gets accepted sooner as the truth.
Now from this second step, which is little taken in modern social studies of science, the way is opened to look at possible gender prejudices in this human interaction proces.
Take a simple one: a theory coming from a woman has less chance to become seen as the truth, than one coming from a man. But now Keller's statement: a model which doens't possess the safe, well known, pleasant and high-status association with masculine, will less easily be interpreted as sound science. Mc Clintock's work was not easily accepted and her model was not as popular as the alternative, and one of the reasons for this may be its subconsious association with feminine.

I strongly believe in the strenght of subconsious categorizing of all kinds of things as either feminine or masculine, and that such a category influences how people relate to it. The main influence is that what's associated with feminine will sooner be disregarded, ignored, and valued less. This will especially happen in contexts which are categorized as masculine, like science and technology.

This points again at the vital importance of looking at what's in that feminine category, and seriously considering if we (humanity) can afford to go on disregarding, ignoring and devaluing it. My view is that this is certainly worth much explicit feminist attention, also at the GASAT-conferences.

Medical Technology and Female Identity
Anne Walton

The only paper on medical technology was that by Marta Kirejczyk entitled "A pregnant couple? Reflections on Gender Character of In Vitro Fertilization" (IVF).

This is a very stimulating paper, with lots of ideas, but the two most important (in my view) are indicated in the following quotation (p 153 Contributions).

"... the observed shift of attention from infertile women to infertile couples provides a new "scientific" basis for inforcing the subordination of women in the sphere of procreation."

Idea 1.

IVF may be used to treat male infertility (although this technique was originally developed to treat women with blocked fallopian tubes).

Male infertility is therefore defined as the infertility of the "couple" so that problems caused by low sperm counts or abnormal sperm may be treated by selecting a limited number of the most viable "normal" looking sperm.

Also, fertile women may be subjected to the "IVF" procedure in order to "treat" practically hopeless cases of male infertility. (see p 159 Contributions)

Idea 2.

Control of women by the medical profession

The woman, not the man, is subjected to the medical procedure and failure to become pregnant (very likely!) is her fault.

Further quotations from the paper illustrate this point:

a) (After the procedure has begun) the medical staff will decide for her when it will be discontinued.

b) (IVF technology) decontextualises the reproductive process of a woman.

c) The reproductive system of the woman is manipulated and the sperm of the man is capacitated.

note Marta Kirejczyk quotes a doctor who actually suggested that "brain-dead women could be used as surrogate mothers"

Attention is focused on a set of organs not on the whole person.

There are other related issues which are important for women. These include the following:

1. The right to choose to have:
a) NO children
b) MANY children
c) a HANDICAPPED child
d) an ABORTION

2. The relative merits of "HI-TECH" and lo-tech childbirth.

HI-TECH childbirth in hospital, is impersonal and controlled by doctors but is probably safer. Lo-tech childbirth, at home is personal, "holistic", more "woman-centred" but may entail greater risk.

3. Amniocenteses (the sampling and testing of the fluid surrounding the foetus). Information obtained from this test may lead to the abortion of a) a female foetus or b) a foetus with a congenital (or other) defect.

4. Hormone replacement therapy (HRT) for menopausal women. Should this be used routinely or only when the symptoms are severe? It may reduce the risk of osteoporosis but are there unknown side effects? Similarly, should hormons be used for the "control" of pre-menstrual symptoms?

5. Screening procedures (used to detect early signs of disease) e g cervical cytology ("smear" tests). Should women be subjected to strong pressures to undergo these tests of does that involve an encroachment of their civil liberties?

How much right should a woman have to insist that these procedures are carried out by a female doctor or nurse?

Frame 4, Part 3

NETWORK AND PRESSURE GROUPS

Jan Harding

Let us first consider the characteristics and functioning of a network.

It may help our thinking to differentiate between networks that are sustained by the dominant culture and those relating to subcultures.

Dominant culture networks

e g the "Old Boys" network in Britain.

Characteristics:

Male: in a patriarchal society

Common background: the name derives from earlier days when successful males were "Old Boys" of the same Public School.

Hierarchical: patronage operates. Initiates pander to ego of dominant members, get known and receive favours.

Experience: common -- belong to the same clubs, participate in common sport (golf, rugby, cricket, tennis), lunch and drink together in pubs, etc.

Organisation: Can occur naturally, given the above conditions.

But ***Freemasonry*** is an example of a more formal organisation. Some other organisations may have an ostensible charitable function e g Rotarians. Network powered by self interest.

Function: to sustain status quo, shared values, facilitate promotion.

Sub-Culture Networks

e g black-consciousness groups, women's groups

Characteristics:

Ethnics minority, female etc.

Common background: disadvantaged, but few shared **connections**.

Egalitarian: (initially) but may be dependent on favourably placed individual's strong character ——> leadership position.

Experience: similar but not **common**. May physically share:

- waiting at school gates
- working in fields etc.

Organisation: usually special arrangements required.

personal contact does not occur naturally.

Network powered by: anger release from sense of isolation, ultruism, self-interest also?

Function: Sharing information,

providing mutual support,

power house to renew energies to return to struggle.

Requires **extra** commitment to normal working.

Commitment dependent on gain? Is self interest a component?

When does "Network" become a "Pressure Group"?

When it develops collaborative **action**?

Does the group have to be "coherent" to become an effective pressure group?

How are networks initiated?

What forms can networking take?

Can tele-technologies facilitate networks?

Is personal contact an important ingredient?

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WHAT INSIGHTS DO WE GAIN FROM PAPERS?

I

Hanne Kock, from Denmark, reports on a seminar for 29 "engineer-women".

The purpose is to share feelings, ideas, analyses around their dual roles as women and as engineers. Their situations generates hostility: from other women, whose hostility towards technology spreads to themselves, and from themselves to the values enshrined in technology. And yet they enjoy the challenges of their work and their skills in tackling it.

The purpose becomes mutual support for individual action

- to organise collective criticism of their own organisation
- to identify constraints on creativity to reflect on technological ideas and to speak out about them
- to continue education
- to organise a network
- to clarify own values position.

Value

- to articulate and explore problems
- to value qualitative explanations
- to take courage in "female" qualities and make them accessible to all.

Seminar is a **stimulant**.

Is this sufficient?

How will it/ought it to continue? As a network, as a pressure group?

Hanne's paper also has useful introductions to frameworks for analyses, eg Arnold Pacey's cluster of values associating with applied technology. Margrit Kennedy's female principles towards nature and technology, and Sue Rosser's "Stages of Transformation" in connection with women's issues.

2

Ann Holmes and Pat Rogers from Canada report on a symposium organised by CEMSAT in Ontario. CEMSAT is the Coalition for Equity in Mathematics, Science and Technology. Its purpose is organising for change. Early meeting revealed the need "to move beyond local meetings to systematic structures and solutions".

A survey was conducted to identify levels of awareness and the extent of action that had been taken. This showed that:

- top level commitment was infrequent,
- equity activities depend on volonteer time,
- key people in influential positions can promote activities.

A SYMPOSIUM of invited delegates was organised. Delegates were involved in planning to facilitate a sense of ownership of outcomes.

Delegates were asked to bring:

- resources and materials used in their areas,
- information about local participation levels,
- accounts of local interventions,
- questions and concerns they wished to raise.

All, of course, relating to girls and women in math, science and technology.

Input to Symposium:

- rewiew of research
- feminist pedagogy.

Workshops: each had specific task which led to redommendations (see p 273 Contributions)

Value to delegates:

- validation of own efforts (first time they had felt this)
- network for exchange of ideas and information and continued support.

Outcomes:

- Report which is intended for formal publication in 1991.
- A Regional Group established in a neighboring urban area to Toronto.
- Recommendations.

Each recommendation eventually led to the setting up of a committee to continue work - BUT no further developments. WHY? Committed people already overstretched.

3

Ruth Carter and Gill Kirkup discuss the functioning of the WISE group at the Open University in the UK as network and pressure group (WISE = Women In Science and Engineering).

WISE activities:

- promotional (some success as women form 17 % of technology students, 26 % of math students and 37 % science),
- seminars for members,
- course units.

Response of administration:

- WISE work is voluntary "has to fit into margins of time"
- but administration appropriates accolades from outside bodies without recognising their source in WISE work,
- EO policy developed in 1987,
- but democratic structures allow unsympathetic staff to block developments,
- support from some senior staff has led to limitied funding.

Need more women in senior positions.
BUT the need to fulfill promotional criteria and sit on committees deflects from members radical intentions.

As a PRESSURE GROUP they feel a sense of failure, but accept the value to members of NETWORK support.

4

Ann-Christine Haupt from Sweden describes the work of the Centre for Women in Research and Working Life at Luleå University of Technology.

In common with other Swedish Universities, Luleå established an Association of Women's studies in 1982. In 1988 this became a formal Centre funded partly by the University and partly by Government.

Objective: to stimulate
- women-oriented research,
- research by women.

The 1990-93 Government Research Bill includes a budget to establish adequate careers for women in research (to the great envy of non-Swedish GASAT participants!)

Centre programme:

Seminar series:
- for interest,
- for self-education.

Outcomes:
- doctoral course unit 1989,
- undergraduate course 1990.

Lunches (termly) to give network support for female researchers.

Plans: - more course options to support the increasing number of female students (women form 30 % of those in technical studies)

In the context of a sympathetic Government the Association/Centre has been able to operate successfully internally within the University and externally, with other centres/fora on the National Technology Research Board etc.

Changes in Physics Curriculum – have we solved the problem?

Symposium by Karin Beyer and Helene Sörensen, Denmark

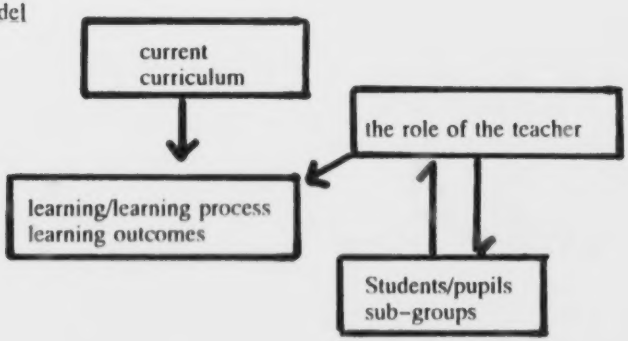
1. Introduction (Karin Beyer)

Girls and Physics – the rise and decline

After pressure from the women researchers about the problem of girls and physics, the teachers and politicians in Denmark agreed that there had to be changes. The physics curriculum for the main school and the gymnasium was, therefore, altered to include an emphasis on context as well as content. The core of physics was retained but it had to be connected to technology and the phenomina in nature. These changes allowed the possibility of a girl-friendly physics but is it enough?

The concern now is that people believe the problem is addressed but no attention has been paid to the social implications of physics or to the history and philosophy of science. The Danes argue that there is still much to be done to explore the interactions in the learning situation before we know what the problem of physics for girls really is.

Model



2. Helene went on to discuss the problem of how we consider differences between girls and boys. Her research and Els-Marie Staberg had focused on different sub-groups and their interaction with different curriculum approaches.

Overall

Boys like to play, dislike reading and writing, blame the teacher, can't work in groups.

Girls take responsibility for group work, question the content, write the reports, they want to understand.

Where girls do well in science - there is self-determination, rules and responsibility.

The categories she identified are:

Types of boys:

Categories:
- science is fun...
- works seriously
- masculine image, mastering, likes lab work
- avoids school, withdraws from work, may play, can't participate.

Types of girls:

Categories: – likes experiments – physical science exciting, likes to investigate and do experiments, works with some classmates, does not work with a girlfriend, likes to have influence
– Difficulties in school – normally no work partner, prefers languages, science is difficult, likes the social contact
– likes school – responsible, takes responsibility for group work, participates in social and learning activities, have to feel involved, science is interesting if you can engage me.
– hard working – makes home work, responsible, social works with girlfriend, science is difficult.

Discussion of presentation

The categories reflect a teachers perspective and concerns. Where does such an analysis take you? The most successful girls – "likes school" category – in a new approach to learning (group based). The traditional science teaching suits the "science is fun" and the "masculine image" boys and very few girls. What strategies can we use for all categories of girls?

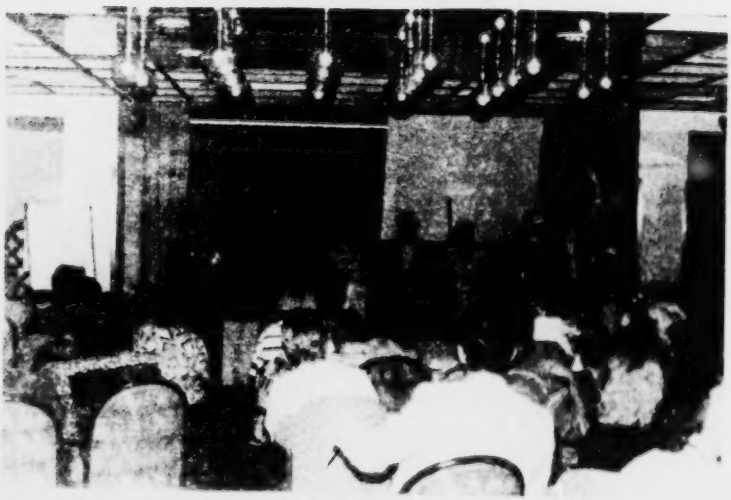
The categories change with time if the girls needs are not met to remove the girls even further from their involvment with science.

A combination of content in a social context and ways of working involving roleplay etc helps girls to be involved in their science learning.

Problems – research tends to focus on attitudes of the girls and/or teachers.

There is a need to see the separate parts of the model on page 1 as interactions. We need to think about a theory of learning that encapsulates the teacher/learner interactions in a gendersensitive way.

Girls need to be challenged and supported in a gendersensitive constructionist approach.



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SYMPOSIUM

Everyday technology and adult education

Studieförbundet Vuxenskolan

Anita Amlén and others

(Adult Educational Association of Swedish Farmers Union and the Centre and Liberal Parties)

There were approximately 25 participants in the symposium.

After an introduction on voluntary adult studies by Karin Söder the discussion treated the basic conditions for the adult study organisations in Sweden. The most important method is the study circle or study group and that method can easily be transformed to developing countries. As it was mentioned in the discussion, in every developing country women can contribute with very much knowledge and the study group is a very good tool for sharing that knowledge and adding new facts.

Mohamed Chaib related experiences from environmental education in study circles and also quoted a Sorbonne-professor that had expressed his opinion that the most important Swedish export product is the special type of voluntary adult education called "folkbildning".

The representatives from the women organisations also related how they use the study circle method to develop their organisations.

More information about the study circle method and how it can be used in developing countries can be obtained from Studieförbundet Vuxenskolan, Box 255, S - 151 23 SÖDERTÄLJE, SWEDEN

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Everyday technology and adult education

One of the distinctive features of adult education is to frame and work out courses emanating from existing needs of education. The methods used are flexible and can easily be adapted to different target groups and to different topics.

Women living in the countryside might have special needs in technical knowledge. The education for their needs can be arranged as follows:

- **Local study circles consisting of ten meetings focusing on a survey of technics. A working plan is elaborated at the first meeting, which implies that the study group takes an inventory and gives priority to certain subject fields, e. g. basic course in electricity, how to conduct a car engine, domestic technology, ergonomics and work environment, how to develop local service by means of technology (e. g. local telematics centres) etc.**

  These study circles are combined with

- Residental courses at an agricultural college (possibly in cooperation with a folk high school) specializing on some topic, e. g. forestry, computer science, telecommunication or how to drive a tractor. The duration of the courses would be two or three days, repeated two or three times.

- An alternative to study circles combined with residential courses might be distance tuition by a folk high school to several study groups, the studies consisting of study circles combined with one or two one-week courses.

Round table discussion

Interactions between teachers and male and female students in geography lessons

by Eva Buff Keller

Based on the study by Margaret Crossmann, in which she explores the reality of classroom interactions between teachers and their female and male students in science subjects, I conducted a small-scale study in geography.

I wanted to know, if there will be found similar results in geography as she found in physics.

In Switzerland geography belongs to the science faculty. Also at secondary school geography is one of the natural science subjects. But as you have social and physical geography, this scince is always between sciences and social sciences and has conflicts on both sides. Because of that, it could be, that also girls and women don't have as many problems as in physics.

The method I used:

I modified the observation paper from M Crossmann (she had taken a modified version of Flanders'Interaction Analysis Categories). Every few seconds I decided to which category the interaction belonged and made a line. I also distinguished between interactions with all pupils, only with the girls or with the boys. I observed four teachers (two female, two male) with two classes for two hours (total 16 hours). They were all competent teachers, who taught their own specialist subject. The topics were climatology, geology, geography of Switzerland, Africa ...

The results you can see on the summary list.

Some comments on my results:

I can only show a tendency, because the sample was too small for definite conclusions. It seems to be that geography teachers, especially women, disadvantage girls. That is a result, that also M Crossmann found.

Summary

Summary		Men					Women					All Teachers				
		Average B 9.3					Average B 10.4					Average B 9.8				
		Average G 8.3					Average G 7.6					Average G 7.9				
		Factor P/G 0.89		G/B% 112			Factor B/G 0.73		G/B% 136			Factor B/G 0.81		G/B% 124		
Category	Nr	G	Total	Factor:			G	Total	Factor:			G	Total	Factor:		
		%	%	G/B %	G/B %	B/G	%	%	G/B %	G/B %	B/G	%	%	G/B %	G/B %	B/G
Teacher Accepts feelings	1	80	0	488	357	0.3	#####	0	####	####	####	80	0	400	324	0.3
T praise	2	71	1	243	217	0.5	55	1	124	91	1.1	61	1	154	124	0.8
T acceptance	3	55	13	120	107	0.9	48	18	93	69	1.5	51	15	103	83	1.2
T memory	4a	53	6	114	101	1.0	49	3	97	71	1.4	51	4	105	85	1.2
T complex	4b	70	5	233	208	0.5	53	6	113	83	1.2	56	5	126	102	1.0
T information	5		26					23					24			
Teacher directions	6a	63	4	171	153	0.7	54	5	116	85	1.2	55	5	123	99	1.0
T writing	6b		11					12					11			
T demonstration	6c		12					2					7			
T criticism	7	44	0	80	71	1.4	18	1	23	17	6.0	23	1	31	25	4.0
Pupil response (recall)	8a	52	3	109	98	1.0	47	1	88	65	1.5	51	2	103	83	1.2
P response (generalisation)	8b	66	3	198	177	0.6	47	3	89	65	1.5	57	3	133	108	0.9
P response (seek clarificatio	8c	50	4	102	91	1.1	45	7	83	61	1.6	47	6	90	73	1.4
Pupil initiation	9	64	1	177	158	0.6	48	3	94	69	1.5	53	2	113	92	1.1
Silence or confusion	10		10					16					13			
Teacher talks		52	78				62	70				58	74			
Pupil talks		48	13				38	13				42	13			
% teacher		10					15					12				
% teacher (only G+B)		55		124	111	0.9	48		94	69	1.5	51		104	84	1.2
% pupil		56		130	116	0.9	47		87	64	1.6	51		104	84	1.2
Total		56	100	127	113	0.9	48	100	91	67	1.5	51	100	104	84	1.2

G = only Girls B = only boys all = whole class total = all + G + B

When you look at the colone B/G every time you have a value more than 1, then boys are favoured. That you can see expecially when you look at women teachers. Another problem you can see is that teachers' talk dominates (>70%), that will also prevent pupils initiatives, especially from girls.

To prove my results there should be done a study with a big sample.

- There should be an intensive discussion about the method. It was very difficult to decide what is going on every four seconds. Sometimes it was difficult to decide to which of the categories the interaction belonged. I had no time to observe interesting interactions. So it could be better for example to make a transcription of the lesson, to take it on video, to use a more qualitative method, to make a special training for the observers etc.

The questions I would like to discuss are the following:

- Is there an imbalance in communication in favour of one of the sexes in geography lessons?

- Are the teachers aware of this imbalance?

- Is the form of communication with girls different from that with boys? I so, in what way? Are different signals given to the two sexes? Are different demands placed on them?

- Do teachers allow either sex to dominate the classroom in geography lessons?

- Are the responses from girls different from those of boys in geography lessons?

- Do girls choose geography as frequently as boys as an optional subject at higher levels?

- Does the sex ot the teacher affect the way boys and girls are treated?

- Are boys criticised more often, are they more respected, are their ideas accepted more readily?

- What conclusions can be drawn on the basis of these observations for the teaching and didactics of geography?

Discussion

The group discussed the methodology of the project and the problems raised by Eva. We felt that the method of observation gave very interesting results, but made very big demands of the observer researcher.

We suggested that the classes could be videotaped, so that the interactions could be studied more carefully, both quantitatively and qualitatively. We thought that the observer researcher should not be a colleague of the teachers observed because:

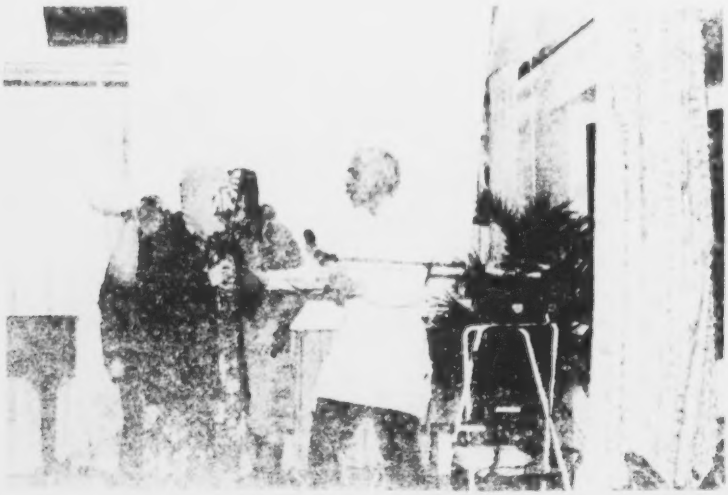
a) the researcher could be too subjective
b) it was hard to reveal negative results to one's own teaching colleagues.

We suggested that two or more observer researchers should analyse the same materials to see if their results were comparible.

On the results of the study, we agreed that it was difficult to make definite conclusions on such a limited sample. We felt that these results plus Eva's further comments indicated that there were some real problems with teacher education in Switzerland. We also felt that the small number of women geography (and even biology) teachers in science jobs indicated that equal opportunities in science education presented deeper problems in Switzerland than in many other European countries.

No other group member had a geography background and we could not say much about gender issues in geography. We noted that geography lies between the natural sciences and the social sciences, which makes it a very interesting discipline from the GASAT viewpoint.

Geoffrey Chivers



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GASAT CONFERENCE'90

ROUNDTABLE DISCUSSION Monday 7th of May, 2030-2200

"Parental influence on girls' choice of education"

Ragnhild Aamot og Veslemøy Nestvold
Norwegian Society of Chartered Engineers

Number of participants: 9

Seven myths about girls choice of education was presented to the group by Aamot/Nestvold. The results from a survey among 250 chartered women engineers and 250 registered women nurses were discussed in the group and the members found their own experiences on this subject confirmed by the results from the survey.

The conclusion was that parents should be included as an important target to a greater degree in information campaigns and other recruitment measures.

MYTHS ABOUT GIRLS AND EDUCATION IN TECHNOLOGICAL CIRCLES

Myth: an imagined simplification of certain questions.

Myth no. 1: More women chartered engineers have parents with graduate university degrees than have women registered nurses.

Myth no. 2: Among girls who choose a higher technical education there are more who have fathers with a high level technical education than among women who are registered nurses.

Myth no. 3: More girls who chose an engineering education on the graduate level have mothers with graduate level education.

Myth no. 4: Among girls who chose nursing careers, mothers had a greater significance for their choice than fathers.

Myth no. 5: Parents of women chartered engineers involved themselves more in their daughters' choice of education than was true for the parents of women nurses.

Myth no. 6: Parents' willingness to give economic support influences girls' choice of education.

Myth no. 7: Girls often follow the examples of older siblings in their choice of education.

III CONCLUSION

1) Social background and untraditional choice of education

Our material seems to confirm earlier research (mentioned in our introduction) which points to a rather distinct connection between social background and untraditional choice of education on the graduate level.

2) The role of parents

The importance of the mother is approximately equally great for both groups generally, for 39,5% of the registered nurses and 36,1% of the chartered engineers. Generally, it may be said that fathers have had great significance for more of the engineers (46,5%) than for the nurses (29%).

Among women chartered engineers who have fathers with a graduate level engineering education, the fathers have had great significance for 75%. However, 55,5% said that their mothers also had been important for their choice. This means that the mothers must have given active support to the idea of the daughters' choosing a higher technical education.

Correspondingly, the figures for registered nurses having mothers with the same or similar kind of education show that the mothers were significant for their choice for 67,8% of them, while the fathers were evaluated as significant by only 35,5%. These figures indicate that for this group, the mother's vocation has been the dominant factor.

In both groups a high percentage (about 80%) answered that their parents had generally encouraged them to take their education, and about 50% indicated that their parents had involved themselves in all the types of education they had expressed an interest in. This we take to mean that parents play a significant role in the entire prosess that goes on until the choice has been made, and that in most cases choice of education is a matter which is debated and discussed many times in the home.

Our material also confirms that a large percentage of parents (40,7% for the registered nurses and 21,3% for the chartered engineers) offered their daughters economic support to finance their studies, and that this was significant to the choice they made. We think it must be agreed that this is a powerful incentive which some parents are in possession of, and which they do indeed use to help their daughters get what they conceive of as a suitable education.

3) The role of siblings

Approximately 20% of the participants from both groups answered that siblings had played an important role in their choice of education.

Among the chartered engineers who had older siblings, approximately 20% had an older brother with the same education, and about 10% had an older sister with the same education. Among the nurses who had older siblings, 4,3% had an older brother with nursing education and 15,5% had an older sister with the same education.

Our figures therefore confirm that girls often choose a kind of education that older siblings have chosen before them. Further, we found that the general educational level of siblings is somewhat higher among chartered engineers than it is among registered nurses.

This difference is especially noticeable as regards older sister's education.

4) The role of other family members

According to our figures, other family members play a less important role in girls' choice of education. Only about 13% in both groups mentioned other members of the family as being important to their choice.

5) The role of friends

Our figures confirm that the influence exercised by girls' circle of friends is considerable.

The influence of girlfriends was of more importance to the registered nurses (47,1%) than to the chartered engineers (36,7%), while boyfriends were important to their choice for a greater number of the girls who chose engineering (43,6%), as against a small number of the nurses (11%).

THE IMPLICATIONS OF OUR SURVEY

Our main conclusion is that parents have great influence upon their daughters' choice of education. We would claim that this is proved beyond doubt by the answers to our questionnaires.

Accepting parental influence on girls' choice of education as an established fact, it is easy to imagine that in families where there is noone who has a higher technical education, the parents may possibly represent a negative influence on such potential untraditional choices of education.

The next question, then, will be to ask what measures could be taken which also would include parents as targets. In other words, how can we direct information campaigns about girls and higher technical education in such a way that the information also reaches the parents?

And further, is it enough to pour out information to students and parents in the form of brochures and posters, or will it be necessary to provide them with more "live" presentations of the interesting career possibilities technical subjects represent for girls?

Women in the workplace: Coping strategies in a male environment

Round Table Discussion by
Stella Williams

16 participants, representing 10 countries.

"But what will women do if they don't have to carry water for hours?" A cartoon was shown to begin the session.

The next century showed not be one of coping strategies but of change for both of women and men in the workplace, to make it productive, challenging, educating and facilitating.

The issue of the universality of science surfaced this morning, but each one of us has to relate the science we know to who we are. We need to see things we want to see and use things we want to use, not what others want us to see and use.

We need a change in our workplaces: in our attitudes, our processes, our approaches. We need to revaluate our own positions in our workplaces as we look toward this next decade and to GASAT's future. We need men who are sensitive, critical, supportive, honest, hard-working.

Women are often judged by the quality and quantity of time they can contribute and often women cannot spend the amount of extra time required because of other (home) responsibilities.

Gender stereotyped jobs vary by cultures and geography. Where a profession is not highly valued, women will be dominant in numbers.

Many men also feel that changes are needed in the workplace. They are unsatisfied by the job conditions and the climate. These issues must be discussed by both men and women – it is not just a womans' issue.

In western society, material wealth gives status. In Ontario, Canada there is legislation that requires equal pay for work of equal value. Thus, secretaries' jobs have been upgraded by as much as 50 %. It has made a great difference in morale as well as financially.

Society still expects certain roles to be played by women. This causes women in positions of authority to have great difficulties. The roll of males must also be changed.

In Kenya, some reasons for few women in positions of authority are the large number of girls drop-out of school. Sometimes women can hurt each other professionally as much as a negative male collegue.

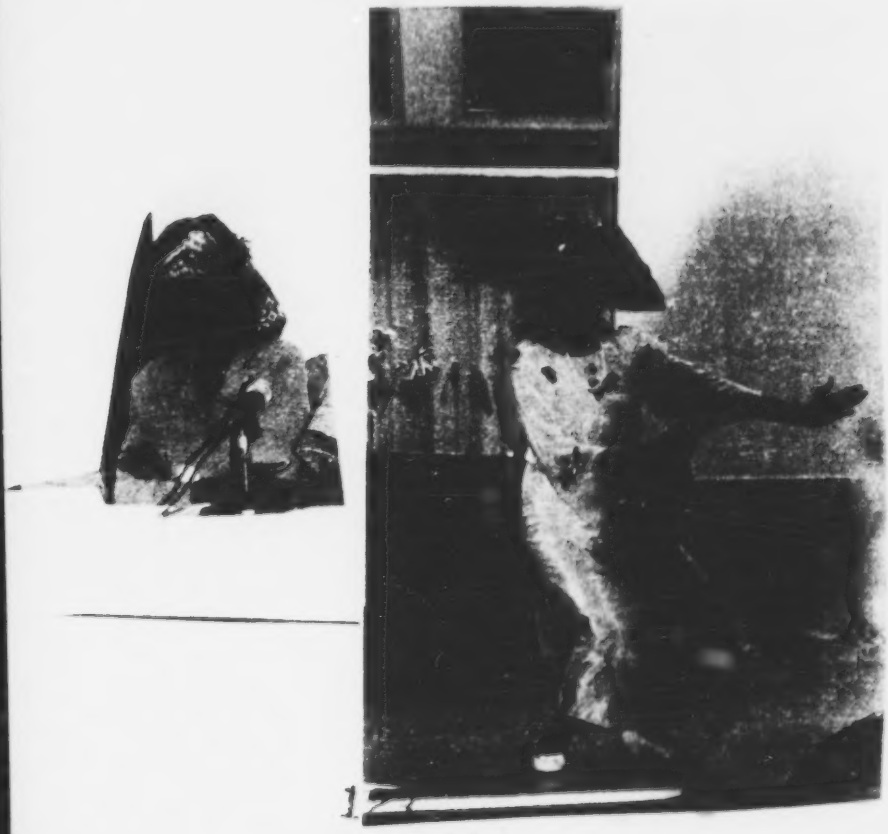
The way in which women approach their work: often they are overachievers. Maybe we need to slow down some.

"Change-agent-projects" were described – activities to produce a positive change for women in the workplace. Once the activity is tried out and succeeds, it is documented in writing and/or video. See the pamphlet "who we are", published by the Ontario Womens'Directorate, Toronto, Canada.

If we want to cope, we have some strategies. If we want to change, we have learned of some ways to do that.

If we have made the decision to take on a job we should enjoy it and feel satisfied.

Throughout the conference we have shared ways to make a difference. Science can be universal, but there are many ways to acquire that knowledge and to use it.



REPORT ON ROUND-TABLE DISCUSSION, JÖNKÖPING, SWEDEN, GASAT 1990

By Sheila M McNab

HOW REAL ARE SEX DIFFERENCES?

The convener of the discussion explained, by way of introduction, that this was the first GASAT conference she had attended. Having perused the themes listed on the conference programme she decided that some of the problems that GASAT was trying to solve were relevant to her own situation. From a modern language background she had come to work in a physics faculty where her main task was to edit science papers written mainly by male scientists. Although she had scanned some of the recent literature and research reports on GASAT topics and had formulated some views on controversial issues, her main reason for convening the discussion was to hear the views of people from other disciplines and other backgrounds. She had fitted some of these topics into a framework which could perhaps serve as a basis for discussion. Each participant was given a copy. The text ran as follows:

> "There is increasing evidence that the differential behaviour and aptitudes of the sexes are due not only to psychological and socio-cultural factors but also to biological and physiological differences. Do you agree that biological and physiological differences affect girls' and boys' approach to maths, science and technology and their success or failure in these subjects? Do you believe that girls should be encouraged to make careers in all branches of science and technology? As educational psychologists, sociologists, course-developers, lecturers and teachers, how do you respond (or how should you respond) to biological and physiological differences? (Even if we all agree that there are more similarities than differences between the sexes, we will undoubtedly admit that male athletes run faster or jump higher than female athletes and that more males than females engage in violent crime!)
>
> You are invited to air your views - within the following framework:
>
> 1. Introduction - biological determinism (evolution - risk-taking by males - males more expendable - division of labour - caring females).
> 2. Slower and later maturity of males.
> 3. Hormonal influences.
> 4. Brain dimorphism (verbal / analytical skills and spatio-lateral skills).
> 5. Childbearing and mothering.
> 6. Male physical strength (aggression, dominance).
> 7. Women live longer (less affected by stress, fewer heart attacks).
> 8. Implications of the differences
>   a) for girls and science and technology;
>   b) for the effective functioning of society."

This outline took some participants by surprise. They had not expected to discuss biological and physiological differences and their effects, since they had already made up their minds on these controversial issues. Several members seemed to be familiar with the vast literature on such subjects and

had reached their conclusions at previous CASAT conferences. They maintained that many of the research methods used by psychologists and physiologists to prove 'differences' were flawed. This became clear from the critical comments that a couple of participants made later about recent research papers on brain differences and about the results of the recent high school maths survey (Benbow) in the U.S. (The convener was disturbed by the apparent reluctance of specialists in one discipline to accept the research results of specialists in another discipline).

Because participants came from such diverse backgrounds and had chosen this discussion group for such different reasons we soon found ourselves talking at cross-purposes. Of course, those members who were extremely fluent in English tended to dominate the discussion. When experts in one field quoted from their specialist literature using semi-technical vocabulary, others had difficulty in following the arguments. One member recalled the statement of S. Garrett: sex is not the same as gender, the former is biological, the latter is socially constructed. Several members - regular CASAT attendees - strongly questioned the validity of biological determinism. It was felt that such themes could only be dealt with satisfactorily if the group were to split into two sections. For various reasons we decided to stay together, to depart from the proposed outline and to concentrate on a few related issues that some members considered to be particularly important.

Later maturity of males was not a problem to science and engineering teachers present in the group. They felt that the teaching could easily be adapted. They echoed the plea of the Australian group for gender-inclusive science and stressed the need to play down or discount sex differences. Their aim was to stretch each individual's capacities to the full. The Swedes in particular felt that what was good for girls was also good for boys. Women should be encouraged to enter all branches of science even theoretical physics. They might in fact turn out to be brilliant teachers and encourage more girls to enter. Evidence was cited that when boys and girls are studying the same subject, be it advanced physics or engineering, their sense of values and their attitudes, as revealed by questionnaires, are very similar. Several members emphasised that differences within one sex are more wide-ranging than differences between the sexes.

A Swedish participant asserted vigorously that there was equality of the sexes in Sweden; women were not over-burdened, child-care was widely available and on the whole Swedish career-women were successful and able to cope. Their dual function did not require them to be 'superwomen'.

The only 'difference' that most participants were prepared to acknowledge was aggressiveness in males. One teacher, however, said that she found definite differences in the behaviour of boys and girls in the classroom. The girls were more careful and responsible and were better pupils, but needed to develop more self-confidence.

Several participants confessed to having a slight guilt-complex about encouraging girls to be engineers, since they felt that they might not be happy in the profession and would want to abandon their careers early on. Some career counsellors had a bad conscience about advising girls to become engineers.

The problem of the isolation and loneliness of the female in computer studies was mentioned. One member admitted that she frequently felt isolated in a male-dominated department. At least two members felt very strongly that girls should not be brought into computer studies for the wrong reasons. They must be introduced to the subject as a full career and not with a view to continuing part-time programming at home later.

Home-working was isolating and ghetto-forming and perpetuated the traditional role and image of women. Computer studies, it was stressed, could certainly be much more exciting than science lessons taught by boring teachers.

In summary, then, most members wanted to:
a) discount differences between boys and girls (if they existed at all, they were unimportant);
b) generate change and action (this was why they'd come to GASAT);
c) improve the teaching of maths and science;
d) bring more women into science and the teaching of science, which should be gender-inclusive science.

There was a difference of opinion about whether men and women should compete with each other or complement each other. GASAT attendees, through their international contacts, are becoming increasingly aware that socio-cultural, economic and political factors determine the role that women are playing or are allowed to play in a particular country. A third world developing country may be obliged to use its female workforce more effectively than a developed country.

Sheila M. McNab
University of Utrecht.

The author thanks the Technology Foundation (S.T.W.) for financing her attendance at GASAT, as part of Project No. XXX99.9020.

Report of the round table discussion

'Feminist visions of a 'social' natural science'

Saskia Everts

The group (around 20 people) first asked for a short overview of the main points of Saskia Everts' plenary contribution. Then 8 discussion questions, all directly distilled out of that plenary contribution, were presented. We divided up in groups according to the question one wanted to discuss. The following questions were selected:

1. 'Is our final aim that there will be no more average differences between some group called women and some group called men? If so, how do we preserve diversity?'

2. '**How** (by which kind of proces) will we try to find out which aspects of female we find are 'feminist' (= we want to retain and teach to more men)'

3. 'Can/must the 'feminist' be a startingpoint for general social change, in particular for a better science?'

4. '(now our feet back on the ground) Which structural aspects of science must change to promote feminist alternatives? Which groups/ trends can we link up with to realize this?'

(Another question: 'is the nature-nurture debate obsolete?' was considered obsolete, and not selected by anyone.)

The questions were discussed up till (and during) lunch. After lunch, a few people met again for a report from the discussion groups.

Group 2 had thought up methodologies and practices, and in the process also dealt extensively with question 1. The group decided to go on working and thinking about this theme, exchanged adresses, and will atttempt to write something about it for Melbourne.

Group 4 limited itself to one feminist alternative on which there was reasonable consensus, namely a more socially oriented science and technology. Things mentioned were: paid time for scientists to popularize their findings, and paid time for 'science-users' to read these reports. Recognition that there is no such thing as 'pure science'. Changing streams of money. Interdisciplinarity to teach people to see the limits of their own fields. Technology Assessment with feedback to scientists and open discussions between science and rest of society.

Overall, we did a lot of 'mindstretching' in this roundtable discussion.

Workshop on
NETWORKING

The workshop was conducted by **Ann Holmes, Canada**. There were 13 participants.

Ann began with her own experience and expressed that if connections are not made among the individuals and groups of induviduals having common goals then the opportunity for growth is wasted. She explained that there are informal networks among the males but minority groups like women are usually excluded. Major decisions are made at informal network places like corridors and toilets. For establishing network, one needs; care, curriculum and connections.

Karin Söder had emphazised the urgent need for establishing networks among women groups.

Ann posed a question to participants and then formed four groups working on some questions.

1. What do you mean by "good" networking, or what are the characteristics of good network, or what does a network look like?

2. What does your group want to know or discuss about networking/pressure groups.

The four groups worked out different posters

Concerns where expressed about how to keep the networks alive. There are factors against "ideal" network. Time, resources, strength in numbers are important factors to keep networks alive. Netwsorks should exist at "equal" level.

Questions emerged

1. Should network be process oriented or task oriented?

2. Should there be a hierachy in the network?

3. How does one keep an individual identity vs group identity in a network?

4. How can the networks create pressure groups?

Jayshree Metha, India

Workshop

"Gender Inclusive Strategies for the Science Classroom : how to use role play, values clarification and creative writing."

McClintock Collective Workshop for European GASAT Conference
May 1990 - Bev Dick & Gaell Hildebrand & Sue Leeds.
1&1/2 - 2 hours

Workshop Aim :

Given that some of the barriers to girls' successful learning in science/technology relate to the general lack of relevance of school science to their lives and to their 'real world', and to the difficulty that many students experience in understanding concepts that are abstract in nature, we as teachers, need to find ways to counter this.

This workshop aims to provide participants with the opportunity to **experience** how the learning/teaching strategies of role play , values clarification and creative writing can be used to promote girls' understanding of, and satisfaction with, scientific ideas and processes.

These strategies encourage students to share ideas, to question, and to help each other formulate and clarify ideas. Cooperation, group involvement, and active participation in a supportive and fun environment are essential features.

Workshop Plan

1. **Introduction & Welcome - 10 mins**
   - to us/aim of the workshop/Oz, Vic, Melb, McClintock/to each other & our work.

2. **Warm Up - 15 mins.**
   e.g. 'Digestive System' role play (each person has a role) or 'Mystery role' on back, discover it via 20 questions, find similarity groups, then think of 3 places in your everyday world where you exist together.
   Discuss adaptations.

3. Role Plays - 30 mins

Take group through different kinds of role plays:-
1. Teacher formulated/directed e.g. cogs role play
2. Student formulated/directed e.g. hot potato chip machine (students decide on total role play) e.g. digestive system or camera/typewriter (where students are given role cards)
3. Make up your own. Choose from a list of e.g. electric circuit, change of state, sugar cube dropped into a hot cup of coffee, an icecream at the beach, the graph X=Y, transpiration, clotting of a wound, cloud formation, a cart rolling down a hill, combustion....

4. Values Clarification - 30 mins

Still in the form of role playing, introduce participants to
4. Teacher formulated/designed e.g. 'Save the Lake' (roles given, p'pants play out and explore their own and others' values through looking at stereotypical reactions/opinions)
5. Teacher designed context/students act as themselves e.g. 'Liver Transplant' or 'Only 10 people can go to the Moon' (a moral dilemma, p'pants have to decide from a limit of options - who goes?. Own value stances are explored).

5. Creative Writing - 25 minutes

We can also explore our ideas, knowledge, understandings and values through writing in science.
1. Have some examples from 'BeeDance' etc to read/show
2. Try some writing & share/discuss.

6. Summing up - 15 mins

1. Ways to use these strategies - discuss alternatives.
2. Action plan for what participants might do next week.
3. Gather feedback about workshop.

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CONTRIBUTIONS GASAT

JÖNKÖPING, SWEDEN

1990

WORKSHOP

To influence attitudes by adult education

We would like to present a suggestion to a project which could be used by adult education to influence womens attitudes to science and technology. We would like to educate women taking care of children.

studieförbundet vuxenskolan

Change of attitudes

If you would be able to change womens attitude to science and technology in the future, you have to start early in a girls life.

Boys and girls preferably ought to have the same chance to be interested in these subjects already in nursery school. Children are much more curious in these ages than later.

Most of the swedish children have no chance to learn science and technology in school before the age of twelve.

Our suggestion to a future project is as follows:

We would like to start **study circles** (study group with 5-20 participants) in science and technology for nurses and nursery school teachers. Almost all of them have chosen not to study these subjects at school. They often have a negative attitude to science and technology, which we would like to change.

Here are some topics for the study circle:

- # Discussion about womens attitudes to science and technology
- # Lights and optics
- # Sound
- # Chemistry
- # Mechanics
- # Electricity
- # Gases (including air)

The meetings will include both easy theory and experiments. The leader of the study circle must have technical experience.

Projects like this could be able to start e. g. among women providing day-care for children. Also at the recreation centres where children , seven to twelve years old, stay in the afternoon after school. Mothers could also be included in the project.

During this Gasat-conference *Studieförbundet Vuxenskolan* cooperates with its three women's organization in a project aiming at "changing attitudes to women and technology".

The Centrewomen

The Swedish federation of liberal women

Emilia - Supporting group for women in Swedish Farmers Union

They all work for
- Equality between women and men
- Change of attitudes
- More women in executive positions
- Political awareness
- More active women in politics
- Aid to women in the third world

studieforbundet vuxenskolan

Adult Educational Association of Swedish Farmers Union and the Centre and Liberal Parties

POSTER

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WOMEN INVENTORS

- ROLE MODELS IN SCIENCE AND TECHNOLOGY -

by

FARAG NOUSSA
3, rue Bellot - 1206 Geneva
Switzerland

1. DO WOMEN INVENTORS REALLY EXIST?

Ask the question around you.

Marie Curie !
And after her?
Well... umm, yes... er...

Apart from the famous Marie Curie, few seem able to mention the name of another woman inventor. Not even if she lives next door! Not even from one's own country!

Yet, Marie Curie was not the only woman inventor to win the NOBEL PRIZE.

Rosalyn Yalow (USA) for instance was awarded the NOBEL PRIZE FOR MEDICINE, 1977.

Her discovery: Radioimmuno-assay, a unique method which permits measurement of biological substances in blood and urine at concentrations as low as 1 millionth of a millionth of a gram.

Unfortunately, women inventors who are recognized and famous are still rare. In fact, women inventors in general are supposed to be a rare species. And because many women inventors are "invisible," other women and men, view inventing as a masculine activity--one at which women have little chance of success.

My interest in the subject started seven years ago, in 1983. It is focused on <u>contemporary</u> women inventors <u>in all continents</u>. I organized several illustrative exhibitions,

"invented" a United Nations special award, gave talks illustrated by slides, and engaged myself in a pioneering venture, a long and demanding educational project: to write a series of books offering role models.

2. THE FIRST BOOK ON CONTEMPORARY WOMEN INVENTORS
A proof that women inventors exist
A source of role models

I am the author of this book. Published in French (1986), its title in English is: "Women Inventors Exist: I have met them."

Two reactions to the book:

The United Nations "International Research and Training Institute for the Advancement of Women" (INSTRAW) wrote the following in their Newsletter:

"In his quest to prove that women are equally capable of technological invention, the author researched, traveled and interviewed world-wide. The results is this series of brief profiles of contemporary women inventors, aged 8 to 81. They come from 26 countries as far away as Nepal, Zaire and Peru.

Their discoveries and inventions range from Nobel prize-winning technology to the gadget: computers designed for autistic children, a new breed of cattle, voice-driven wheel-chairs, pesticides, portable rice mills, safe switches, herbal products, semi-synthetic antibiotics, toiletries, ultra-thin photographs and a knitting machine.

Written in simple language and in journalistic style, this book provides engaging role models for young adults, showing that women can grasp technology, that they can master the complexities of algebra and physics, or construct time-saving devices for daily life."

Dr. Giuliana Tesoro, Professor at New York Polytechnic University, and who has to her credit more than 100 inventions, wrote to the author:

BEST COPY AVAILABLE

"The broad spectrum of fields of activity and personalities represented by the women inventors in the volume shows that creative ideas are not a prerogative of men. The message is clear and elegantly conveyed by the facts reported. For women students and young career women generally, your book provides evidence that their accomplishments can be recognized in our society, and I believe that this fact can motivate them even more than the promise of financial rewards."

3. My future projects:
A SERIES OF OTHER BOOKS ON CONTEMPORARY WOMEN INVENTORS

These books, with drawings and photographs, are aimed at adults and children. They will be written in English, and published in different languages.

It is not my aim to draw up an exhaustive catalogue of women inventors--which, in any case, would be impossible--but to highlight the contribution of contemporary women to the world of invention, by giving some outstanding examples. These books will also encourage young girls to embark on a career in science and/or technology.

Rolex Awards for Enterprise acknowledged the quality of my project in April 1990, and decided to include it in their list of "Selected Projects" for the 1990 Rolex Awards.

WHAT ARE THESE BOOKS?

3.1 A book on
CONTEMPORARY WOMEN INVENTORS IN GENERAL

Adaptations from my 1986 book, with new portraits of women inventors, particularly from European countries.

Two books are already under preparation.

In Finnish, (publication date: August 1990) with portraits of women inventors from Finland and other Scandinavian countries.

Aino Heikkinen is one of the Finnish role models. She invents in the field of manufacturing concrete.

Barbro Hjalmarsson, a Swedish nurse, invented a new method for testing sedimentation rate.

In Dutch, this book is partly sponsored by the Ministry of Education and Science of the Netherlands. Publishers are needed if this book is to appear by the end of 1990 as planned.

Heidi Bogaerts-Könnecker, Dutch by marriage, German by birth, is one of the role models here. Her invention is a new chemical process for producing the world's thinnest photograph. The most important among many applications is in publicity and advertising displays using transparent images and slogans which are presented in sequence at regular intervals.

3.2 A book on
WOMEN INVENTORS AWARDED THE GOLD MEDAL OF WIPO
- A UNITED NATIONS AGENCY

It will be published in English and French, in August/September 1990, by the World Intellectual Property Organization (WIPO), a specialized agency of the UN dealing principally with inventions.

Dr. Rosalyn Yalow, Nobel Prize for Medecine, 1977, has accepted to honor the publication with a Preface.

Some 35 outstanding women and girls from 21 countries, and all continents, have received this coveted award.

Among these women, two remarkable Russians are featured:

Victoria Kovalevskaya, inventor of several types of mine-ventilation machines.

Dr. Eleonora Egorova, developed new techniques for micro-eye surgery.

The **Third World** is represented by inventors from:

Cuba (a new meningitis vaccine)

Egypt (a device that tests the effects of Sun's rays on the cloth, paper, leather and other materials)

Zaire (a microbe-detecting technique which uses saliva and an elementary microscope)

and from many Asian countries such as China, the two Koreas, Mongolia and the Philippines.

3.3 A book on
WOMEN INVENTORS IN THE FIELD OF COMPUTER SCIENCE

80% of this manuscript has been written, in English and French. I am looking for interested publishers.

Here are three of the **role models** featured in the book.

Ada Byron Lovelace, daughter of Lord Byron, poet, was the first programmer, in 1843, in history. Today, a major programming language bears the name of ADA.

Grace Hopper, retired Rear-Amiral of the US Navy, is considered a pioneer of software. She developed the world's first compiler, in 1952. The invention of the compiler by Grace Hopper was a sensational breakthrough that opened up an era of limitless horizons for automatic programming. In 1957, Grace Hopper created the first language suitable for business data processing.

Martine Kempf, a young French woman from Alsace, invented a voice-activated micro-computer. It is used in particular in microsurgery since 1984.

3.4 A CHILDREN'S BOOK ON WOMEN AND GIRL INVENTORS

This book will include about 12 chapters.

Each chapter will deal with two female inventors--one adult and one child--who have created in the same field. Their inventions will be described, illustrated by drawings and photographs.

Here are three of the **youthful role models** in this book.

Suzanna Goodin, an American aged 6 1/2 years, designed a spoon-shaped biscuit for cats and dogs. Instead of needing to be washed up, the spoon is broken into the pet's feeding dish after being used to scoop food out of the can.

Becky Schroeder, from Ohio, USA, is the youngest girl in the world with a patent. At the age of 10 years, Becky invented a luminescent sheet to slide under paper to enable people to read and write in the dark; she was granted a patent when only 12.

Emma Emden, a Swedish girl from the region of Göteborg, invented a disposable bib at the age of 13. Not only can bibs be thrown away as paper handkerchiefs, but--better still--they come on a roller and can be torn off like paper towels.

3.5 A book on FILIPINO WOMEN INVENTORS AS AN EXAMPLE TO WOMEN IN THE THIRD WORLD

I visited the Philippines twice, in 1989 and 1990, and discovered that more than 200 Filipino-patented inventions were devised by women, and that their inventions covered extremely varied fields.

Over 20 Filipino women inventors were interviewed from housewives to university graduates. Many had set up their own businesses and commercialized their products; some career women occupied important positions in research and technology institutions.

This book will be published in 1991, in English, in Manila, the Philippines.

Ms Leticia Ramos Shahani, Filipino Senator, and Chairperson of the Senate's Committee of Foreign Relations, has agreed to write the Foreword.

Magdalena Villaruz is one of the role models for this book. Named Inventor of the Year in the Philippines in 1986, she is a prolific inventor, with 15 patented inventions to her credit--all of which are in the field of agriculture mechanics considered very unfeminine. The most successful invention and Ms. villaruz's main stock in trade, is a tractor specially designed for cultuvating in wet soil.

POSTER

By Berit Hindgård

WELCOME TO

Teknikstugan i Alingsås

- the Studio of Technology in Alingsås, Sweden

Presentation at the Gasat conference in Jönköping May 1990

TEKNIK stugan

Advisor no. 1

"We have short courses for girls of 10, 12 and 14 years of age. Many continue on our supplementary courses. We have had 400 participants since the start in January 1989.

The Studio of Technology offers a challenging leisure activity with focus on future developments within the field. Isn't it easier to learn outside school?"

Anna Helleteg, SKF, Göteborg

Advisor no. 2

"I've learnt a lot by beeing an advisor. We've had courses in CAD, DTP and other computer programmes. Last Easter we went on an educational visit to Paris.

Many advisors have got good jobs in industry thanks to their involvement with the studio."

Agneta Johansson, Ranaverken, Trånad

Advisor no. 3

"For girls, technically speaking, the end suffices the need. We need a motivation for exertions in technology. Many boys, though, are fascinated by technology for its own sake.

A better awareness would help us to understand the pros and cons of the subject. More girls should be educated in technology."

Anna Selmarker, Energiverken, Göteborg

Don't be afraid of technology!

The paradox is that although computers and technical equipment are more common everywhere, the number of young people with technical hobbies has decreased.

Girls should be encouraged to develop technical skills at an early age. They must learn to master computers and machines. Those who are afraid of technology can never become interested in the the subject.

Some examples of our equipment

Computers	4 IBM PS/2 model 70. Canon laser printer. IBM Page scanner. HP plotter
Program	AutoCAD. Arts & Letters. PageMaker. Word Perfect.
Knitting	3 Zippy manual machines. 1 computer controlled Empisal Knitmaster.
Video	Camera. 2 video and 1 audio tape recorders. Editing mixer.

Intercom

At the Studio pupils assemble their own intercoms. Girls are just as gifted in this field as boys - but they often lack experience in trying it out.

Knitting machine

We live in a technical world. Technology is not always what boys dream it to be. Our studio is open to everybody, not only those wishing to become engineers and technicians.

Quotations from pupils

"It's nice to be able to experiment with computers and different kinds of apparatus in a quiet environment - without having a lot of boys around who think they now best."

Karin, 12

"Our advisors are very nice and helpful. I wish this course lasted 10,000 evenings."

Susanne, 10

"Now I look forward to physics lessons at school - I'm beginning to understand."

Eva, 14

"The Studio of Technology is the best thing that's ever happened."

Johanna, 12

Results

So far the Studio of Technology can boast that:

1 Almost all girls in primary school, who have been invited to attend our evening courses, have done so.

2 Advisors, who are around 20 years of age, are capable of conducting highly qualitative and demanding courses in technology.

3 Close co-operation between school and industry can widen horizons for young people - and increse their job prospects for the future.

It remains to be seen whether our Studio can increase the female participation within the technical education lines at high school level or not. We think we'll succeed!

The CNC lathe

Nowadays more and more girls are studying technically oriented subjects. Industry offers an exciting working environment. Jobs there often require less physical exertion than the work loads experienced by women in traditiuonal working roles.

Educational visits to the Studio

Our unique approach in introducing technology to girls has caught the interest of many people in Sweden. We have many summer courses geared to developing girls skills in practical areas. The general response has been positive. People involved in these courses are especially interested in the togetherness created by our pupil first policy.

Industry needs more and more qualified technicians. The picture shows training and recruiting officers from the Volvo Group at a recent visit to our Studio.

Course activities

Computers	Badges. Letter papers. Invitation cards. Furnishing houses in CAD with tables, chairs, beds, stoves, etc.
Electricity	Connecting batteries, lamps, switches, motors, etc.
Plastics	Vacuum forming of boxes, car bodies, sign posts, etc.
Knitting	Sweat bands. Caps.
Video	Recording and editing of fashion shows, disco dancing, etc., etc.

Evaluation

"Information alone is not enough to stimulate an interest in technology with young people. In particular, girls must gain practical and technical experience by trying themselves. It is vital that some of the tasks are hard to accomplish.

The sure way for a girl to make her daddy proud is to complete her courses at the Studio of Technology."

Kersti Helgesson, psychologist

Our chairman

Berit Hindgård is a civil engineer. She has worked seven years as a designer. At present she is teaching at secondary school level, concentrating in mathematics, physics and technology.

Why did we start the Studio of Technology ?

"The staff at the Studio have been encouraged by the fact that girls, who have passed through our faculty at Alströmerskolan, have subsequently done very well in their careers. What we have to do is to open the doors of technology for more and more girls.

Through our work at the Studio people can explore and experience just how exciting and stimulating technology is and how vital it is for our future."

Ingemar Axelsson
Master of Science Engineering
Founder. Project leader.

English translation:
Mr. Brian Foster. Alin

Poster by Elizabeth Whitelegg 138

Developing supported selfstudy materials for women in science

Gender plays a significant role in learning and it seems that styles of learning affect women far more than men.

Styles of learning are promoted through:

Context

- ***Context of the learning material is far more important to women than to men.***

Content

- ***The content should be relevant to women's lives, so should start from applications of physics rather from the theoretical perspective.***
- ***Controversial applications allow students to express their own views and lead the learning to become more personal.***

Style of the text

- ***The text should address women so that they feel comfortable with the material and they feel that it is appropriate for them, and they are not constantly trespassing on a male preserve.***

Assessment styles have a crucial influence in women's performance

Assessments that encourage women feature:

- *Open rather than closed questions*
- *Continuous assessment with no final examination*
- *Variety of formats for presenting work (via tapes,presentations to groups etc)*
- *Extended, reflective forms of expression rather than factual, listed details.*

Supported self-study is suitable for women because:

- *Women are anxious not to expose their misconceptions in public, this form of pedagogy enables them to find a solution to their areas of difficulty in private first*
- *Studies have shown that mature girls are likely to take physics at school. Supported self-study offered to women later*

in life, gives a second chance to those for whom physics wasn't appropriate at school

- *Supported self-study at home fits in with care of dependants*
- *If a woman tutor is not included in the scheme, this pedagogy is less reliant on the tutors' attitude*

Elements of Supported self-study courses for women:

Confidence raising strategies such as

- *Women-only introductory residential weekends*
- *Positive reinforcement throughout the text via a carefully structured programme of formative problem-solving activities*
- *Opportunities for additional help with mathematics*
- *Informal workshops for women to "play" with apparatus*

Role models

- *Exposure to other women's stories. Women who have achieved success in science in order for the women to develop high expectations*
- *Work shadowing*

Support

- *On going support throughout the course from tutors and councillors*
- *Regular local meetings with peers for self-help*

Various Entry Points

- *Presentation of the study material in short modules so that it can be taylored to a variety of different women's need and backgrounds*
- *Pre-tests that offer alternative routes through the study material according to the women's knowledge*

These examples of text come from an Open University supported self-study, in-service package : Physics for Science Teachers

The in-service course is aimed at secondary science teachers who do not have sufficient knowledge of physics to teach it up to the 16+ GCSE examination.

This course was written by a team of people consisting of an unusually high proportion of women authors - for a physics course. The core team consisted of 7 men and 6 women.

Many of the teachers taking the course are biology trained and so many of them (about 55%) are women.

I have examined the course material (which I helped produce) to see if the high number of women on the course team helped make it more appropriate for women students.

Some of the women teachers on the course have commented to me that they did not feel out of place on the course compared to other experiences they have had.

As the course delivers information on how to teach physics to secondary school pupils it includes material on teaching methodologies and has a section on gender issues and equal opportunities.

Captions to examples of course material

Women-Friendly Assessment
Examples of open-ended questions that require extended, reflective forms of expression.

Women-Friendly Assessment
Examples of questions where context is appropriate for women (and men).

Role Models
Text that validates women's presence in science and technology

Context is Vital
Learning through applications of physics that are important and relevant to women's lives

Women's Presence
Visual evidence that women exist in the world of physics and appear in the illustrations.

POSTER by Liv Sissel Grönmo 141

Students' choice in upper secondary school in Norway

This is a research programme at Centre for Science Education at The University of Oslo which started in The autumn 1989.

1. Background

A new way of organizing the upper secondary school in Norway takes place this and the coming school year. The main change is that the students get more freedom of choice in the range of subjects they can study. So far the students have had to choose between three branches of this theoretical education; social sciences, natural sciences and languages. The students are no longer required to specialise in one branch; they can choose their subjects across the curriculum.

2. Goals for the project

We want to examine which subjects the student choose and their reasons for the choice. More precisely we want to:

- examine which students choose which subjects(related to sex, occupational plans etc.)
- analyse the reasons for the students' choice, the reasons they give themselves as well as other aspects that may influence them
- analyse the consequences of their choice related to later studies and occupation
- examine more closely some subjects (Math, Physics, Biology, Chemistry and English)
- discuss the consequences of the new way of organising the upper secondary school, with greater freedom of choice for each student

3. Methods

An extensive questionnaire were used in 2-3 classes in 22 upper secondary schools in Norway. 1 600 students at the age of 16 were asked about the following:

- sex and background
- which subjects they choose and for what reasons
- their reasons for not choosing some subjects
- their plans for further education and occupation

- their marks in some school subjects
- their attitudes to some ethical questions
- their opinions for learning some subjects (Math, Biology, Chemistry, Physics and English)

We use computers to handle all this data.The programme we use is an advanced statistics programme called SPSS (Statistics Programme for Social Sciences)..

4. Participants in the project

Svein Lie is in charge of the project. Other participants are Carl Angell, Elisabeth Ibsen, Elisabeth Vetleseter and Liv Sissel Grønmo.

5. Some results from the project

The collection of the data was finished in early April. We have just started analysing the data and can therefore for the time being only give a few examples of results from the project. Reports will be worked out this summer. The data compiled can be processed further if more economic support is given to the project.

REASONS FOR LEARNING MATH AND BIOLOGY

The students were asked to rate several statements as regards the learning of Math and Biology. The values are 1 (not important), 2 (somewhat important) or 3 (very important)

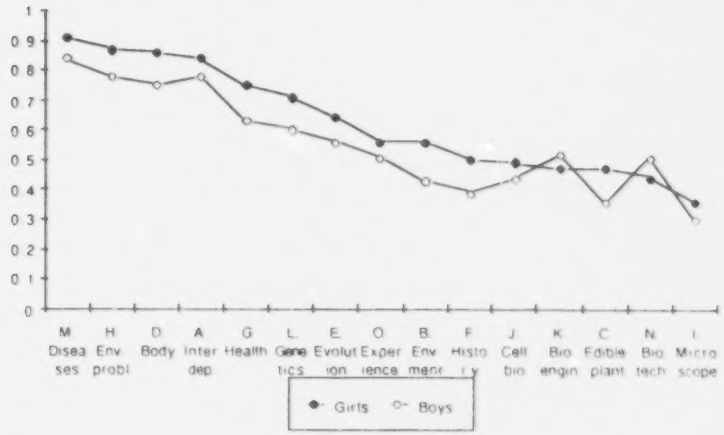
On the basis of a frequency count we have calculated an index of importance for each statement. Maximum index value: 1 (meaning all answered very important) and minimum index value 0: (meaning all answered not important).

Students rated the following reasons for learning Biology:
A. Interdependence in the nature
B. Knowing the plants and animals in the local environment
C. Collecting and making use of edible plants
D. Functions of the human body
E. Theory of evolution
F. History of science
G. How to live healthily
H. Environmental problems

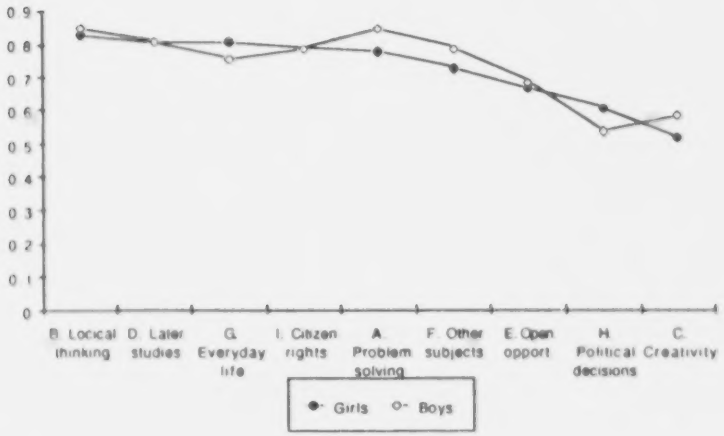
I. Microscope studies
F. Cellbiology
K. Bioengineering
L. Genetics
M. Human diseases
N. Biotechnology
O. Experiencing nature

Students rated the following reasons for learning Math:
A. Learning problemsolving methods
B. Develop logical thinking
C. Develop creativity
D. Useful for later studies
E. Keep all opportunities open
F. Useful in other subjects
G. Math in everyday life
H. Political decision making
I. Secure your rights as citizen

GRAPH 1. Reasons for learning Biology according to sex



GRAPH 2. Reasons for learning Math according to sex

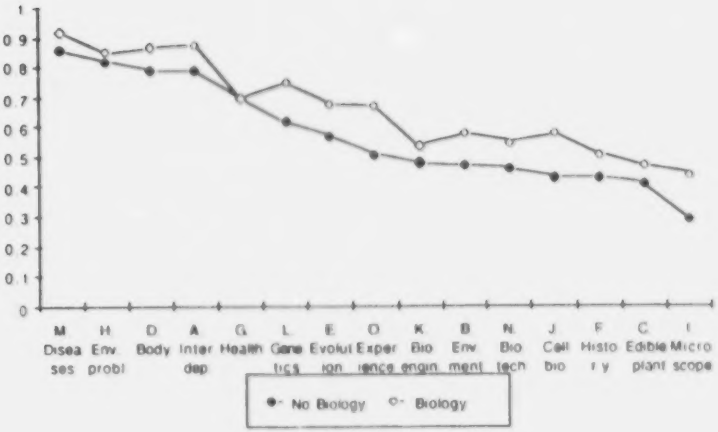


Graph 1 and 2 show how girls and boys value 15 different reasons for learning Biology and 9 different reasons for learning Math.

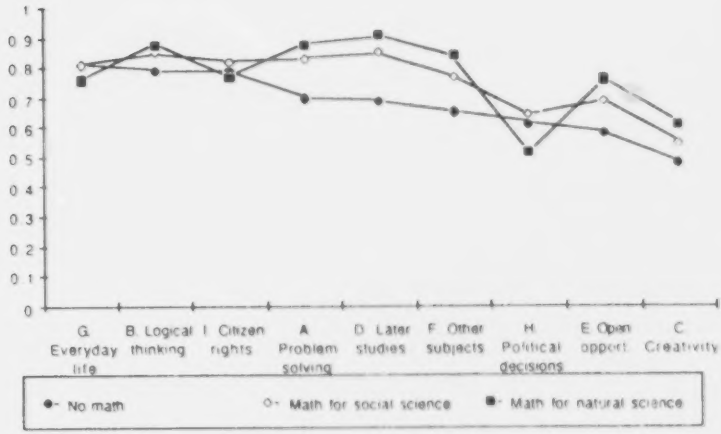
In Biology girls rated 13 of the reasons higher than the boys. 2 statements about biotechnology were given better rating by the boys.

In Math girls gave most of the reasons a lower rating than the boys, only two statements about everyday use of Math were given a higher rating.

GRAPH 3. Reasons for learning Biology according to subject choice



GRAPH 4. Reasons for learning Math according to subject choice



Graph 3 and 4 show how students who have chosen Biology/Math rate the reasons for choosing the subject as compared to the students who have not chosen the subject.

Students who have chosen Math are divided into two groups; Math for social sciences and Math in natural sciences.

Students who have chosen Biology gave all the 15 statements a higher rating than those who have not chosen the subject.

The two groups have approximately the same score concerning reasons related to healthy living and environment and diseases.

Students who have chosen Math rate 6 of the 9 reasons higher than those who have not chosen the subject. Students taking the natural sciences tend to rate everything higher.

Reasons for using Math in everyday life are rated highest by those who have chosen Math for social sciences.

ATTITUDES (TO SOME ETHICAL QUESTIONS)

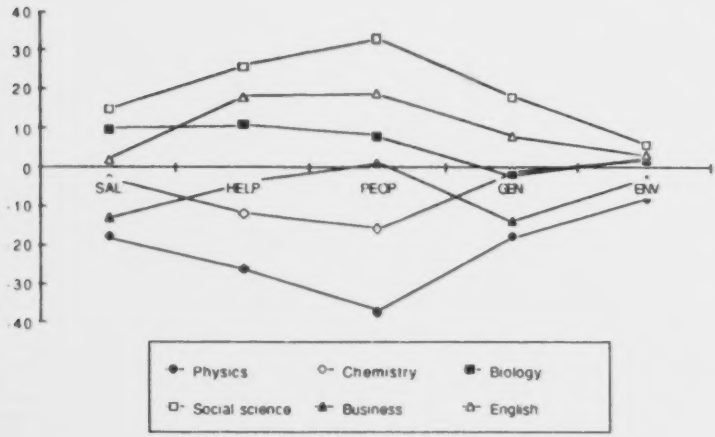
The students were asked to give their opinions about some ethical statements. They rated their opinion from total agreement to total disagreement for each of the statements.

We have standardised to the mean= 0.0 for each statement. Standard deviation = 100.

The ethical statements were :

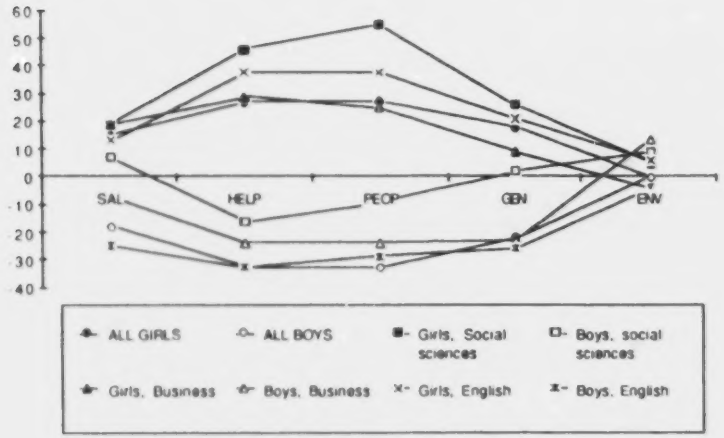
SAL = high salary non-important
HELP= important to help other people
PEOP= important to work with people instead of things
GEN= worry about biotechnology (manipulation of genes)
ENV= concern about the environment

GRAPH 5. Attitudes (to some ethical questions) according to subject choice

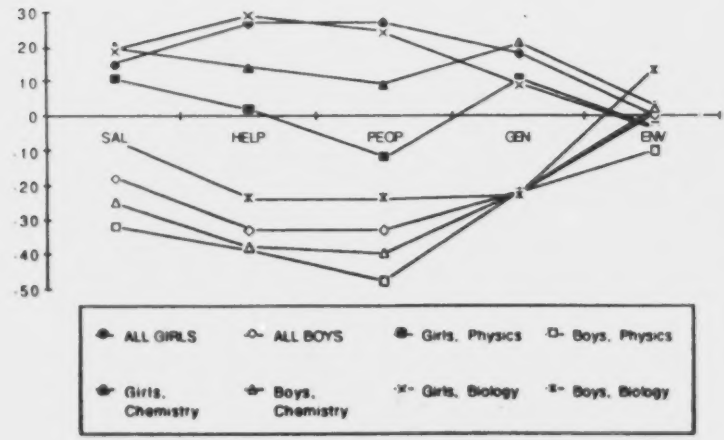


Graph 5 shows how students` attitudes to this ethical questions are divided by subject choice. Students choosing social sciences score highest on every statement, while students in Physics score the lowest. All groups seem to agree on a concern for the environment.

GRAPH 6. Attitudes (to some ethical questions) for girls and boys according to subject choice



GRAPH 7. Attitudes (to some ethical questions) for girls and boys according to subject choice of natural sciences.



Graph 6 and 7 show girls and boys scores related to each subject of choice. Girls score higher than boys on every statement except for the one about concern for the environment where all groups score approximately the same.

In natural sciences boys choosing Physics score the lowest while girls in Biology score the highest. Girls in Physics score lower than other girls for most of the statements, they seem to be more in agreement with the mean score for "all boys" than "other girls". But the difference between girls and boys is quite clear no matter which subject of study they have chosen, except again for the statement about concern for the environment. So far it seems to be common in all groups to be concerned about the environment.

6. Further plans for the project

This is a few results from our project. We will make several reports this summer, some will be translated into English and sent to people who are interested in this kind of research. We also hope to analyse the results more closely next year. All this depend on the amount of economic support we get. We think the data can help us to develop some interesting perspectives related to the goals for the project if we go further in analysing the material we have collected.

If you want more information about our project, feel free to write to:

Liv Sissel Grønmo
Centre for Science Education
SLS, University of Oslo
P O Box 1099 Blindern
N - 0316 OSLO 3
NORWAY

POSTER

SUMMER PHYSICS COURSE FOR GIRLS IN THE NETHERLANDS

Loes Roelofs, MENT-project, University of Technology,
Eindhoven, The Netherlands

Introduction

In the Netherlands pupils in secondary schools have to choose their subjects for examination when they are 14+. After exams they must choose further education or a job. Many further education institutes have entrance requirements. Often mathematics and physics are obligatory for further education. This means that pupils who have dropped maths or physics have reduced their possibilities for further education. Especially girls avoid science subjects in secondary education. So, girls' options in further education are reduced. Senior technical education for instance demands maths and physics and as you can guess, the participation of girls in this education is very low: only c. 2% of the pupils is female.
The aim of the MENT-project (translation: girls, physics and technology) is to increase the participation of girls in senior technical education. One of the strategies of the MENT-project is to develop and organize physics courses for girls who have dropped physics for examination. Afterwards they can go to senior technical education (Fig. 1).

After secondary school exams, the girls follow this physics course in the period june/july and afterwards they can start senior technical education. Thus, these girls do not loose time, because the course starts just after exams and before the school year begins. The Ministry of Education and Sciences supports the courses financially. The girls who pass a test at the end of the course may go to senior technological school.

	girls	boys
maths	46	76
physics	13	50

Table 1. Percentage of girls and boys for examination for their secondary education in maths and physics in the Netherlands in 1987; CBS 1988/89.

Why not for boys ?

Scientists in many kinds of disciplines argued why it is important for girls to do science and technology (Fox Keller 1987; Selby 1988). Economical, philosophical and psychological arguments showed that society, men, science and technology will benefit if the participation of women in technology increases. Thus, it is important in this case for secondary technological schools to give summer courses in physics for girls.
There are many reasons for girls to drop physics at school. Kelly (1987) mentioned three main reasons:
- girls lack of self-confidence;
- masculine image of physics;
- impersonal approach of science.

She also suggests that girls are discouraged to choose physics by the role of schools and teachers. There are psychological/development type theories which explain the difference in choosing physics as a subject for girls and boys (Head 1987; Harding & Sutoris 1987). Also the physics curriculum, the behaviour and attitudes of (physics) teachers towards girls and boys are factors that influence the choice of pupils. It affects this choice in such way that boys choose physics and girls tend to avoid this subject. Since physics is a conventional choice for boys, I think that in general the boys who don't choose physics have less capacities for it than the girls who don't choose it. So technical schools can expend more efficiently their energy and efforts in special physics course to girls chance than to boys.

Some results of the 1989 try outs

In the summer of 1989 16 senior technical schools organized the first MENT physics course. In this course all kinds of pupils participated: both girls and boys, both pupils who did and did not meet entrance requirements. Allocation of the pupils to the course was done by the school administration. Most schools did not want to refuse boys or pupils who doubted their capacities for senior technical education, even if they met entrance requirements.

girls		*boys*	
with physics	*without physics*	*with physics*	*without physics*
8	*12*	*125*	*20*

Table 2 Number of girls and boys paricipating in the physics summer course in 1989.

From table 2 we can conclude that more boys followed this course than girls and there were many candidates that met the entrance requirements of technical education. Most of those pupils were advised by the technical school to do the course, because they had rather low marks for physics. This means that boys dominated the classrooms and teachers paid most attention to pupils who already had the qualifications for technical education. This was certainly not the aim of the physics course.

This year the MENT-project tries to reach more girls for the course. The main problem is that it is easier to get boys for this course than girls. To interest more girls we developed special leaflets for girls. The leaflets informed the girls about senior technical schools and the physics course. We sent the leaflets to a large number of secondary schools. We hope we are able to start three to five groups of 14 girls. This will increase the participation of girls in the first year of the senior technical education with c. 50 girls. In this way, the population of girls at senior technical schools would increase with 10 percent.

POSTER

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Engineering, Marine Sciences, Broadcasting, Air and Marine Transport, Fisheries, Environment, Medical Sciences, Environmental Sciences, Biotechnology, Telecommunications, Natural Resources....

What do all of these careers have in common?

NOT ENOUGH WOMEN ARE CHOOSING THESE FIELDS!!!

WISE CHOICES

a poster series produced by

Women in Science and Engineering
Newfoundland Chapter

This series of 12 posters was produced by the Newfoundland Chapter of Women in Science and Engineering (WISE) to encourage young women to pursue careers in the science and engineering fields. The brightly-coloured, eye-catching posters display photographs of actual role models, brief descriptions of their jobs, and information regarding the fields, and the study required to enter them. Eleven of the posters depict both male and female role models in the fields listed, while the twelfth poster is a general composite with only women represented.

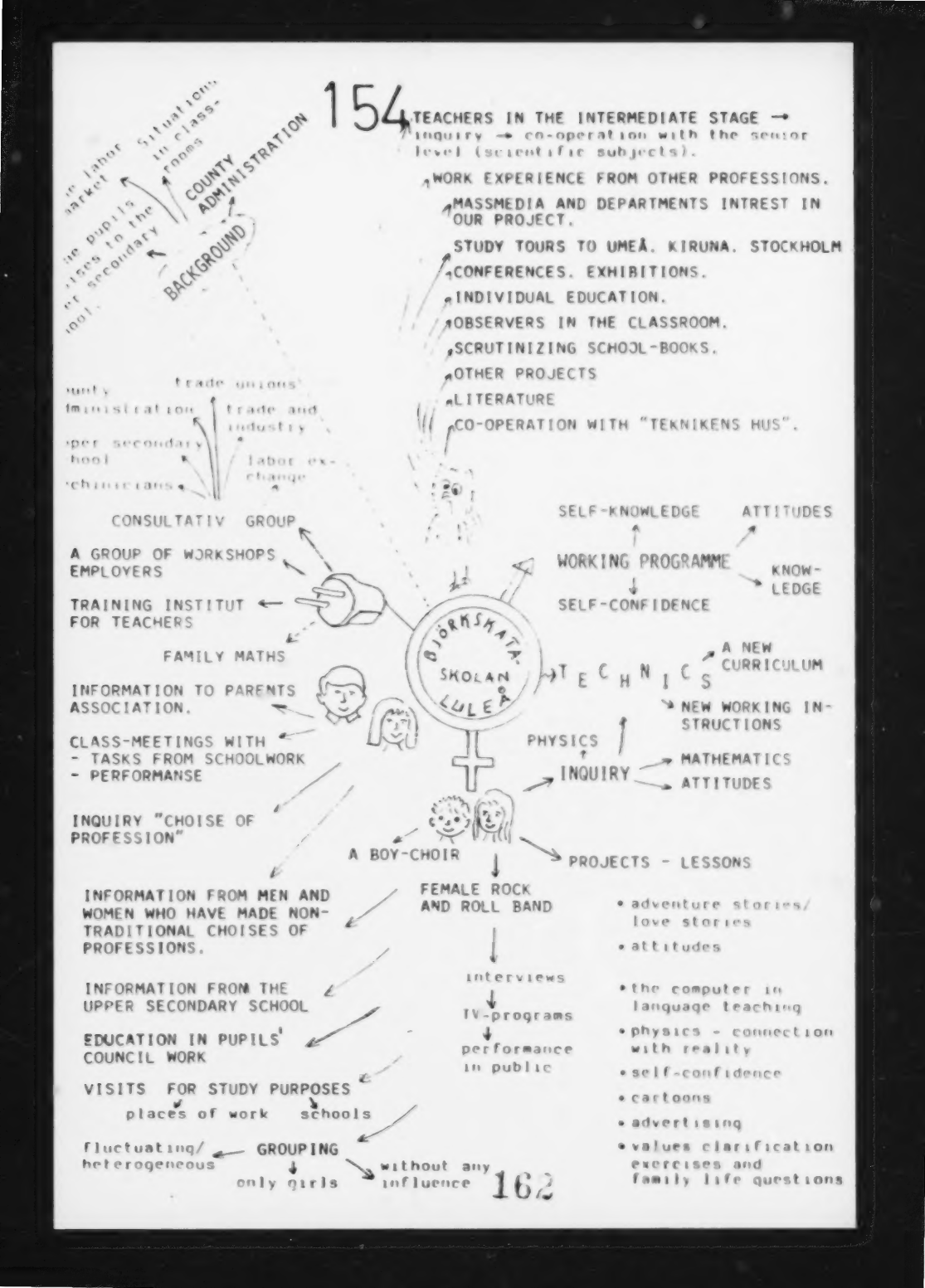
Schools will find these posters invaluable guidance resources.

Designed for WISE Newfoundland by Dave Roe. Photography by Ray Fennelly.

To obtain your own set contact:

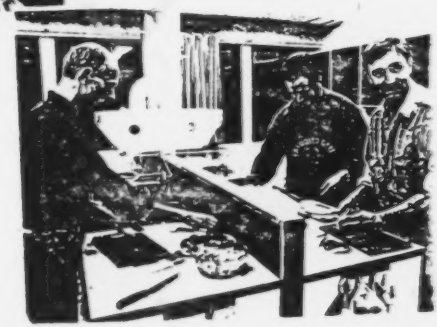
WISE Newfoundland, 114 Empire Avenue, St. John's, Newfoundland, Canada A1C 3G2.
Telephone: (709) 754-1435. FAX: (709) 738-3276.

[Please enclose a postage and handling fee of $25.00 Canadian with your request].


TEACHERS IN THE INTERMEDIATE STAGE → inquiry → co-operation with the senior level (scientific subjects).
WORK EXPERIENCE FROM OTHER PROFESSIONS.
MASSMEDIA AND DEPARTMENTS INTREST IN OUR PROJECT.
STUDY TOURS TO UMEÅ. KIRUNA. STOCKHOLM
CONFERENCES. EXHIBITIONS.
INDIVIDUAL EDUCATION.
OBSERVERS IN THE CLASSROOM.
SCRUTINIZING SCHOOL-BOOKS.
OTHER PROJECTS
LITERATURE
CO-OPERATION WITH "TEKNIKENS HUS".
COUNTY ADMINISTRATION
BACKGROUND
trade unions
trade and industry
labor exchange
CONSULTATIV GROUP
A GROUP OF WORKSHOPS EMPLOYERS
TRAINING INSTITUT FOR TEACHERS
FAMILY MATHS
INFORMATION TO PARENTS ASSOCIATION.
CLASS-MEETINGS WITH
- TASKS FROM SCHOOLWORK
- PERFORMANSE
INQUIRY "CHOISE OF PROFESSION"
BJÖRKSKATA SKOLAN LULEÅ
SELF-KNOWLEDGE
ATTITUDES
WORKING PROGRAMME
KNOW-LEDGE
SELF-CONFIDENCE
TECHNICS
A NEW CURRICULUM
NEW WORKING INSTRUCTIONS
PHYSICS
INQUIRY
MATHEMATICS
ATTITUDES
A BOY-CHOIR
PROJECTS - LESSONS
FEMALE ROCK AND ROLL BAND
interviews
TV-programs
performance in public
• adventure stories/ love stories
• attitudes
• the computer in language teaching
• physics - connection with reality
• self-confidence
• cartoons
• advertising
• values clarification exercises and family life questions
INFORMATION FROM MEN AND WOMEN WHO HAVE MADE NON-TRADITIONAL CHOISES OF PROFESSIONS.
INFORMATION FROM THE UPPER SECONDARY SCHOOL
EDUCATION IN PUPILS' COUNCIL WORK
VISITS FOR STUDY PURPOSES
places of work
schools
GROUPING
fluctuating/ heterogeneous
only girls
without any influence

TARGET GROUP: SCHOOL PERSONNEL AND PARENTS

PARENTS WERE INVITED TO THE SCHOOL TO GET AN IDEA OF WHAT OUR INTENSIONS WERE. WE WANTED VERY MUCH THAT PARENTS PLAY A ROLE IN THE ATTITUDECHANGE PROCESS IN STUDENTS. DURING THE MEETING OF THE PARENTS OF THE 7TH GRADERS OPPORTUNITIES ARE PROVIDED FOR PARENTS TO TRY THE SCHOOLWORKACTIVITIES THAT THEIR CHILDREN DO.
THE FATHERS HAD TO DO WEAVING, MAKE A FRUIT SALAD ETC. THE MOTHERS WENT TO THE PHYSICS, TECHNICS AND CHEMISTRY CLASSROOMS WHERE THE FIXED A BICYCLE, ASSEMBLED AN ELECTRICAL EXTENSION FLEX AND USED A SOLDERING IRON. THEN THE MOTHERS WENT TO THE MUSIC CLASSROOM AND PLAYED WITH THE DRUMSET TO ILLUSTRATE THAT GIRLS CAN BE MORE THAN JUST SINGERS. OUR FUNDEMENTAL PURPOSE WAS TO PROVIDE CONCRETE ILLUSTRATIONS FOR PARENTS TO REACT TO.



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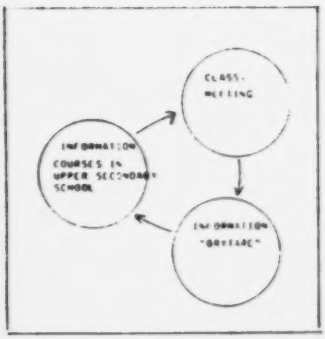
WE GAVE THE PARENTS IN THE 8TH GRADE A MUSIC THEATRE PERFORMANCE THAT WAS DESIGNED TO PROMOTE DIALOGUE BETWEEN THE ACTORS AND THE AUDIENCE (TEACHERS, PARENTS AND PUPILS) ABOUT SEX ROLES, SEX IDENTITY AND EQUALITY. THE ACTORS CAME FROM THE SECONDARY SCHOOL (AGED 16 - 18). AFTER THE PERFORMANCE, THE ACTORS TOOK PART IN THE DISCUSSION WITH THE PARENTS.

BEFORE STUDENT IN THE 9TH GRADE ADVANCE TO THE NEXT GRADE, THEY NEED TO MAKE DECISIONS ABOUT WHAT COURSES THEY WANT. STUDENTS INTRESTED IN DIFFERENT CAREERS MAY WANT TO TAKE DIFFERENT CLASSES SO WE ARRANGE A "THEME EVENING". IT WAS ORGANIZED SO THAT ALL SIX CLASSES (PARENTS AND PUPILS) ROTATED BETWEEN THREE STATIONS IN GROUPS OF TWO. ONE STATION WAS CONCERNED WITH EDUCATIONAL CHOICES, MUCH LIKE THE FUNCTION PLAYED BY A GUIDANCE COUNSELOR IN THE USA. A SECOND STATION GOT PARENTS AND STUDENTS TOGETHER WITH THEIR HOME ROOM TEACHERS. AT THIS STATION THE PARENTS COMPLETE AN EXERCISE WHERE THEY ESTIMATE THEIR CHILD'S SUITABILITY FOR VARIOUS JOBS. PUPILS HAD COMPLETED THE SAME EXERCISE BEFOREHAND AND AFTER PARENTS FINISH THEIR RATINGS THEY GOT THEIR SONS OR DAUGHTERS ESTIMATES ON AN OVERHEAD THEY COULD PLACE OVER THEIR SCORES FOR COMPARISON. AT THE THIRD STATION. PARENTS AND PUPILS COULD TALK TO PIONEERS OR ADULTS WHO HAD MADE NONTRADITIONAL CAREES CHOICES (E.G. MALE NURSES, FEMALE SURVEYOR). THE PIONEERS RELATED INFORMATION ABOUT THE JOB MARKET, THE SCHOOLING THEY NEEDED, WAGES, WORKING CONDITIONS AND THE FUTURE OUTLOOK FOR THE PROFESSION.



HOW WELL WOULD YOUR SON OR YOUR DAUGHTER FIT INTO FOLLOWING JOBS?

FOR THESE JOBS THAT YOU THINK FIT VERY WELL MAKE YOUR MARK MORE TO THE RIGHT. FOR THOSE JOBS THAT YOU THINK LESS WELL MAKE YOUR MARK MORE TO THE LEFT. MAKE A MARK FOR ALL THE JOBS IN THE LIST AND THEN CONNECT THE LINES.

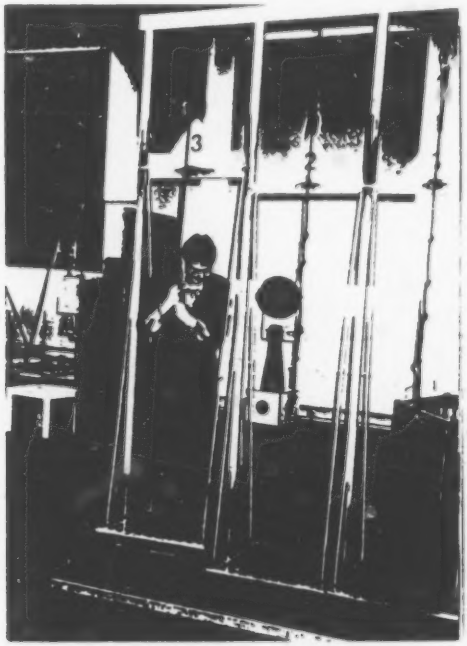
	LOW — HIGH
LAWYER	
ARCHITECT	
FIREFIGHTER	
CONSTRUCTION WORKER	
CHAUFFER	
COMPUTER TECHNICIAN	
SALES CLERK	
LIBRARIAN	
AIRLINE STEWARD	
HAIRDRESSER	
CLOTHING DESIGNER	
OFFICE WORKER	
SMALL BUSINESS OWNER	
RECREATION LEADER	
JOURNALIST	
DOCTOR	
POLICE	
VETERINARIAN	
BUILDING MAINTENANCE WORKER	
TEACHER(BEGINNING STAGE)	
ENVIRONMENTAL CONTROL OFFICER	
RESTAURANT WAIT STAFF	
ACTOR	
HOSPITAL ORDERLY	
FARMER	
COOK	
FARMER/FORESTRY	
MUSICIAN	
PILOT	
MECHANIC	

TO ENCOURAGE TEACHERS TO PLAY AN ACTIVE ROLE IN THIS PROJEKT WE HAVE GIVEN THEM "SOMETIMES WINE AND SOMETIMES WATER". THE STUFF HAS MADE STUDY TRIPS, HAS TAKEN PART IN CENFERENCES AND ENROLLES IN CONTINUING EDUCATION. TEACHERS HAVE ALSO MADE VISITS WITH THEIR PUPILS TO SEE WORKPLACES, WHICH FOR STUDENTS OF ONE SEX, ARE NONTRADITIONAL (E.G. AUTO REPAIR SHOPS FOR GIRLS).

TEACHERS HAVE VISITED EACH OTHER'S CLASSROOMS TO TRY TO IDENTIFY CONSCIOUS AND UNCONSCIOUS BEHAVIORS WHICH AMONT TO DIFFERENTIAL TREATMENT OF ONE SEX OR THE OTHER (E.G. EASIER QUESTIONS FOR GIRLS. MORE ATTENTION TO BOYS).

IN EACH OF THE MAJOR DISCIPLINE AREAS (LANGUAGES, SCIENCES, SOCIAL SCIENCES) WE HAVE A SEX EQUALITY COORDINATOR WHO ASSISTS OTHER TEACHERS IN EVALUATING TEXTS, FOR SEX BIAS AND ENCOURAGING TEACHING TECHNIQUES TO COUNTER THE BIAS.

FROM A FUMBLING BEGINNING THE STUFF HAVE DEVELOPED AND BECOME VERY INTERESTED AND ENGAGED IN SEX EQUALITY ISSUES. TODAY IT IS OBVIOUS THAT TEACHERS HAVE INTEGRATED SEX EQUALITY PERSPECTIVES IN THEIR TEACHING.



TARGET GROUP: PUPILS

TARGET:

- TO FIND METHODS AND FORMS IN OUR WORK IN ORDER TO INFLUENCE BOTH BOYS AND GIRLS IN THEIR ROLE OF SEXES, ESPECIALLY WHEN THEY CHOOSE WAYS OF STUDY AND THEIR JOBS IN THE FUTURE.
- TO DEVELOPE THE SELF-CONCEPTION AND ATTITUDES OF BOTH BOYS AND GIRLS.
- TO CHANGE THE CONTENT IN CERTAIN SUBJECT ABOVE ALL IN THE SCIENCES AND ESPECIALLY IN TECHNICS, SO THAT GIRLS' AND BOYS' VARIOUS EXPERIENCES AND INTERESTS WILL BE TAKEN IN CONSIDERATION.

THE TARGET OR OBJECTIVE WITH PUPILS IS TO CHANGE THE ATTITUDES THAT PUPILS RELY ON TO MAKE DECISIONS ABOUT THEIR CAREER CHOICES. WHEN PUPILS WHO ARE PART OF THE TARGET GROUP ENTERED OUR PROJECT IN 1987 WE MADE A SURVEY OF THEIR ATTITUDES AND EXPECTATIONS. AMONG OTHER QUESTIONS WE ASKED WHAT PROFESSION THEY WOULD CHOOSE AFTER AFTER GRADUATION. THE RESULT ARE SHOWN IN THE DIAGRAM. IN AN ATTEMPT TO CHANGE WE HAVE DIRECTED STUDENT VISITS TO NONTRADITIONAL OCCUPATIONS. GIRLS HAVE VISITED REPAIR SHOPS AND BOYS HAVE VISITED DEPENDENT CARE FACILITIES. PUPILS HAVE THE OPPORTUNITY TO INCREASE THEIR TIME VISITING TYPES OF POTENTIAL FUTURE OCCUPATIONS BEYOND THE MINIMUM LEVEL.
WE HAVE ALSO BEGUN "THEMEDAYS" WHERE STUDENTS AND TEACHERS FROM THE UPPER LEVELS VISIT OUR SCHOOL TO PRESENT INFORMATION ABOUT DIFFERANT AREAS OF EDUCATIONAL SPECIALIZATION (OCCATIONAL SKILLS, COLLEGE PREPARATION, TRADES, ETC). THESE PRESENTATIONS ARE OBLIGATORY FOR ALL STUDENTS OF THE 9TH GRADE. IN THE 8TH AND 9TH GRADES, STUDENTS GO OUT FOR 2 WEEKS EACH YEAR TO GAIN WORK EXPERIENCE. THE 8TH GRADE FIELD EXPERIENCES ARE INTENTIONALLY DESIGNED TO PROVIDE EXPOSURE TO NONTRADITIONAL OCCUPATIONS.

PROFESSIONS (THE MOST CHOOSEN)

CHOSEN BY BOYS	NUMBER	CHOSEN BY GIRLS	NUMBER
PROFESSIONAL ATHLETE	18	HAIRDRESSER	18
ENGINEER	12	JOURNALIST	8
COMPUTER TECHNICIAN	8	CLOTHING DESIGNER	8
PILOT	5	TOUR GUIDE	8
TRAINER OR COACH	5	ACTOR	7
JOURNALIST	4	TEACHER	6
COMPUTER PROGRAMMER	4	VETERINARIAN	5
MECHANIC	3	AUTHOR	5
SALES CLERK OR BUYER	3	AIRLINE STEWARD	4
SCIENTIST OR ASTRONOMER	3	SALES CLERK OR BUYER	4
ARCHITECT	3	TEACHER KINDERGARTEN	3
TRUCK DRIVER	3	CHILD S NURSE	3
DOCTOR	2	OFFICE WORKER	3
TEACHER	2	ARCHITECT	3

THE INITIAL STEP TAKEN IN OUR PROGRAM TO IMPROVE THE SELF CONFIDENCE OF FEMALE STUDENTS WAS TO GIVE THEM THE OPPORTUNITY TO PLAY IN A ROCK AND ROLL BAND. THE RESPONSE WE RECIEVED WAS OVERWHELMING. IN A FEW WEEKS, TEN ALL GIRL GROUPS WERE FORMED. TODAY WE HAVE MORE THAN 15 GROUPS, MOST ALL GIRL AND SOME MIXED WITH BOYS.

IN AN OTHER EFFERT TO CHANGE ATTITUDES. WE HAVE BEGUN "THEMEDAYS" ON FAMILY LIFE AND SEX EDUCATION. THE CONTENT IS CONCENTRATED ON DISCUSSING PERSONAL FEELINGS AND TAKING RESPONSIBILITY FOR ACTIAS. PART OF THE CLASS IS SPENT ON VALUES CLARIFICATION EXERCISES THAT ENCOURAGE FRANK DISCUSSION ABOUT SOCIAL MORES AND FAMILY LIFE PROBLEMS.

ANOTHER EXERCISE INVOLVES HAVING STUDENTS SELECT SELF DESCRIPTORY ADJECTIVES FROM THE LIST PICTURED IN THE DIAGRAM. THE STUDENT'S LISTS OF ADJECTIVES THEY CHOOSE CAN PROVIDE USEFUL MATERIAL FOR DISCUSSION AND. MORE IMPORTANT FOR FACILITATING POSITIV CHANGES IN SELF IMAGE.

HARDWORKING NERVOUS GLAD CALM
SHY DISAGREEABLE SAD
TROUBLEMAKER PRACTICAL CLOWNISH DULL
NOISY BUSY KIND NAUGHTY FUNNY
NICE HANDSOME ELEGANT TALKATIVE
QUITE STUBBORN SWEET SMART LAZY
TEASING UNCERTAIN FUSSY MESSY
ORDERLY SCARED TRUSTWORTHY DILIGENT
LOUD UNDEPENDABLE DIFFICULT
GOSSIPING GENEROUS TIMID GOODLOOKING
MEAN SENSIBLE NEVER CRY POUTING
INSENSITIVE HANDY PRETTY JUST
UGLY CRY SOMETIMES TECHNICAL
FRIENDLY HEAVY WEAK GOOD NATURED
STRONG CONTRARY BRAVE TOUGH
COSY EXCITABLE RESTLESS

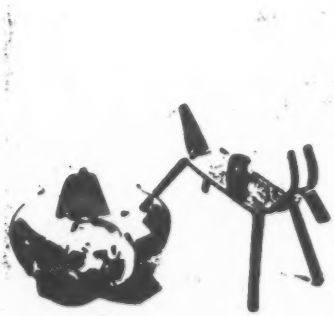
INSTRUCTIONS:

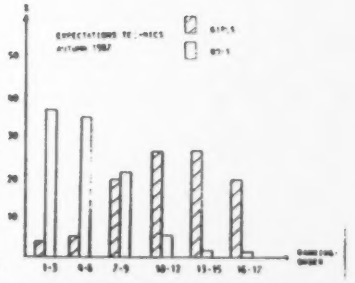
1. CIRCLE THE TWENTY WORDS THAT BEST DESCRIBE YOU.
2. UNDERLINE THE TEN WORDS THAT DESCRIBE YOU BEST O THE TWENTY.
3. MAKE TWO LISTS OF THE TE WORDS. LIST 1 SHOULD BE WORDS THAT ARE POSITIVE. LIST 2 SHOULD BE WORDS THAT ARE LESS POSITIVE.

TO DETERMINE HOW BEST TO IMPROVE PHYSICS COURSEWORK WE INTERVIEWED 10 STUDENTS (5 GIRLS AND 5 BOYS) FROM EVERY 9TH GRADE CLASS. WE ALSO GAVE THE STUDENTS IN ALL 8TH AND 9TH GRADES AN EQUIRY ABOUT THEIR COURSE-WORK IN TECHNICAL EDUCATION GENERALLY.
WE INTERVIEWED 5 STUDENTS TOGETHER, GIRLS SEPARATED FROM BOYS. THE MA-JORITY OF BOTH BOYS AND GIRLS WANTED MANY MORE PRACTICAL LABORATORY EXERCISES, THEY WANTED BETTER EXPLANATIONS OF NEW WORDS, SLOWER WORK-ING PACE AND, MAYBE THE MOST IMPORTANT DISIRE, EXAMPELS AND EXPLANA-TIONS CORRESPONDING WITH THEIR EXPERIENCES AND REALITY.

INSTEAD OF CHANGING THE CURUCULUM WE HAVE TRIED TO CHANGE OURSELFS AND OUR TEACHING. WE ALSO TRY TO COMPLETE THE "MANLY WORLD" IN THE BOOKS WITH EXPLANATIONS AND EXAMPLES FROM THE "GIRLS WORLD".

THE SURVEY ABOUT TECHNICAL EDUCATION REVEALED THAT GIRLS FOUND THE SUBJECT DULL AND WITHOUT ANY MEANING. THE PROJECTS THEY DID THEY FOUND UGLY AND WITHOUT ANY USEFUL PURPOSE. GIRLS WANTED TECHNICAL EDUCATION TO BE MORE RELEVANT TO THEIR EVERYDAY LIFE AND HOME LIFE, FOR EXAMPLE: HOW TO DO BICYCLE REPAIR, CARPENTRY, HOW TO FIX DRAINS AND FAUCET AND HOW TO FIX PICTURES AND SHELVES TO DIFFERENT WALL MATERIAL.





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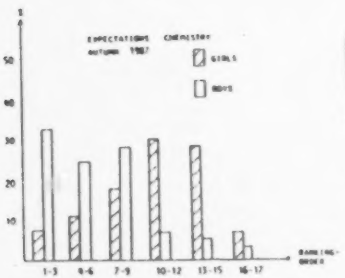
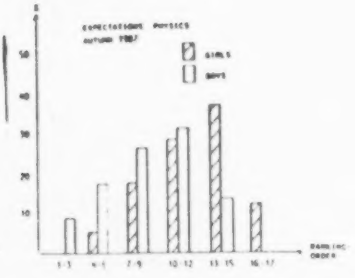
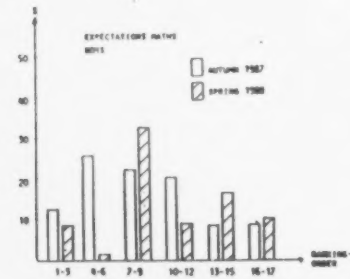


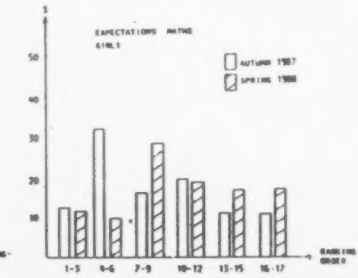


IN AUTUMN 1987 WHEN OUR TARGET-GROUP ENTERED OUR SCHOOL. WE ASKED THEM TO RANK THE SUBJECTS. THEY SHOULD GIVE NO 1 TO THE SUBJECT THEY THOUGHT WOULD BE THE MOST INTERESTING, NO 2 TO THE NEXT BEST SUBJECT, AND SO ON. THE INQUIRY SHOWED BIG DIFFERENCES IN THE EXPECTATIONS OF BOYS AND GIRLS FOR THEIR COURSEWORK. LOOK AT THE DIAGRAMS.

IN SPRING WE REPEATED OUR SURVEY AND THEN WE FOUND SURPRISING DIFFERANCES IN MATHEMATICS. WE FOUND THAT A SUBSTANTIAL PROPOTION OF BOTH GIRLS AND BOYS WERE INTERESTED IN MATHS IN THE AUTUMN SURVEY BUT THAT MOST HAD LOST INTEREST BY THE TIME WE DID THE SPRING SURVEY. LOOK AT THE DIAGRAM FOR MATHEMATICS.

AFTER WE DISCOVERED THEIR STRIKING LESS OF INTEREST IN MATHS WE STARTED TO LOOK FOR CHANGES IN THAT SUBJECT TOO E.G. WE BEGAN TO INCLUDE MANY MORE PRACTICAL LABORATORY EXERCISES, FAMILY-MATH EDUCATION ETC.





Poster By Margriet Brugman and Henriette Horlings

EVENT - UTRECHT THE NETHERLANDS

EVENT, The Expertise centre of Women's emancipation in Economics, Natural sciences and Technology, is a centre within the institute of higher education in Utrecht (Hogeschool Utrecht).
One of EVENT's objectives is to increase the number of women who choose a study in the area of: economics, informatic technology, architecture, town and country planning, geodesy, civil engineering and cartography.
To make the right choice it is necessary for youngsters to obtain useful information at the right time.

Secondary school girls often have a vague and incorrect picture of professions in those fields.
Until recently one could hardly find women in such positions.
Girls were not stimulated to choose for such studies and professions, neither at school, nor by friends or at home.
Until now, the information available has been abstract and focussed on men.
In this project EVENT developes good vocational guidance material for secondary school girls of 15-18 years old.
Several videotapes, brochures and leaflets will give a more realistic picture of professions in what used to be a man's world.
Videotapes of ten minutes each will illustrate one sort of profession. For that reason EVENT has contacted women, who already have positions in those fields.

Together with educationalists of the Hogeschool Utrecht and the professionals EVENT developes the content of the material (videotapes, brochures and leaflets).
Some professionals will act in the videotapes as models. They will emphasize the interesting and agreeable aspects of the positions, without romanticising them.

EVENT has got important information on the moment of choice in their lives for a study in economics, technology and natural sciences; the daily tasks of those positions; how it is to work in an environment with male colleagues; their planning for the future, etc.
At this moment, May 1990, about fifty women have responded to EVENT's request. Several meetings with female professionals have already taken place.

Most women are enthousiastic about giving their assistance to the project, in spite of their busy jobs.
This summer the information material will be available. EVENT will introduce the pictures of professions in the orientation days of the Hogeschool Utrecht in October 1990.
Naturally other groups than the Hogeschool Utrecht and EVENT itself will get the opportunity for using the material.

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PRESENTATION OF THE VIDEOTAPE 'SIZE 38. A FOOTNOTE FOR WOMENGINEERS' AT THE GASAT CONFERENCE, JÖNKJÖPING, 6-11.5.90

The video, which is "a story about gender, feet, prejudices and engineers", has as its primary aim to motivate girls to pursue a career in engineering. But the video should also be seen in a larger context. It aims at encouraging girls to take some more daring steps and a broader look at the educational possibilities that are open to them as well as to the boys.

As to the background - why the video was made. The percentage of women in higher technical education in Norway is 21 at college/undergraduate level and 26 at university/graduate level. Although these percentages may seem high in a European context, they are still low compared to the participation rate of women on an average in higher education in Norway, which is about 50 %.

The target group of the video is the age group 15-17. This is the stage of their schooling at which young people opt for type of secondary education - the crucial choice of mathematics and physics, which to a large extent includes or excludes the possibility of taking up studies in engineering.

The video intends to speak the "language" of this target group, and as to form and effects it works on various levels. There is a facts and figures level in the video, visualized by means of foot and cake metaphors running throughout the film. There are some elements of music videoes, and above all there is humour - irony and double meanings - the use of which may often be effective in breaking barriers and exposing double standards and prejudice.

Thus the video also works on the subconscious level, trying to bring into daylight the various myths and misconceptions about girls and technology. (For instance the misconception that boys are cleverer than girls in mathematics, or that you have to be a kind of genius to become an engineer.)

Within the symbolic framework of feet and steps to take in order to shape your own life, the video literally aims at giving girls some kicks. Norway appears to be among the Western countries with the strongest sex segregated labour market. Roughly speaking, men choose between 300 different occupations, whereas women only choose between 30. And women are noteably less paid than men. On an average, women only earn 81% of a male salary. So the video asks provocative questions like "What is the reason why girls queue up for types of education that are underpaid or out of demand on the labour market? Is it because they are stupid, or are they just lacking courage?

Another important element of the video is the function of identification. The video intends to provide role models for

girls by presenting young, sympathetic female engineers, who are enthusiastic about their job, and the professional, social and economic opportunities it opens up.

Thus the video works on the image of the engineer, and intends to demystify and humanize the concept of technology and engineering.

Being intentionally provocative, the video aims at starting a discussion and creating an increased awareness that will hopefully contribute to change the very traditional attitude that most girls still have concerning suitable education and occupation for women.

Material available from The Engineering Education Council of Norway:

Video: "Strørrelse 38. En fotnote for Kvingeniører" (with English subtitles).

Leaflet: Temahefte (background material and discussion topics for the video, in Norwegian).

Leaflet: "Velger du matte og naturfag, står du sterkt" (a small leaflet encouraging girls to choose mathematics and natural sciences, in Norwegian).

***Mary's** school friends said "go for it". Her mother said "it will make you sick". Mary wanted to work with her father. Today, she's a mechanic. A mechanic with a difference, she models in her spare time.*

***Sadie** didn't take physics in high school. She thought it was only for "the smart kids". Sadie didn't let that stand in her way. Today she's an engineer.*

***Nancy and Jo-Ann** left their small fishing communities to go to school in the big city. They were terrified to discover that there were few girls at the technical institute. They stuck with it, and today they are food technologists.*

***Brenda** had a dream to do research. She got married and had two children. The dream was put aside, but her divorce brought the necessity of supporting her children. Her dream took her back to school to become a lab technologist.*

WISE CHOICES

a video produced by

Women in Science and Engineering
Newfoundland Chapter

This video was produced to encourage female high school students to pursue careers in science- and technology-related careers. Career education, science, industrial arts, and home economics teachers will find this program an invaluable guidance instrument, while general audiences and women's groups will find it an excellent catalyst for discussion.

Written and produced for WISE Newfoundland by Sharon Halfyard, TETRA. Sponsored by the Government of Newfoundland and Labrador, Department of Education; the Atlantic Canada Opportunities Agency; and Industry, Science, and Technology, Canada. Format: VHS. Time: 26 minutes.

For preview, rental, or purchase, contact: WISE Newfoundland, 114 Empire Avenue, St. John's, Newfoundland, Canada A1C 3G2. Telephone: (709) 754-1435. FAX: (709) 738-3276.

G A S A T Conference

Frame 1 Discussion

Question 1: Many countries are placing an emphasis on primary science. General opinion is that starting earlier will improve attitudes towards science, especially among girls. What topics are taught? How is it taught? How are teachers trained to teach science? How many hours are spent teaching science? What are the reasons for including science in the primary curriculum?

Participants: Total 11: Sweden 6, Australia 2, UK 1, Denmark 1, Netherlands 1.

Policy in primary science education
Sweden and Britain have national curricula. These began in 1980 and 1989 respectively. They are legally binding on schools for the teaching of technology in Sweden and science in Britain at primary level. Implementation in both cases was problematic. This was due to the fact that it was not clear **what** was supposed to be taught. Also teachers did not know how to teach science and technology. It is clear that if science and technology are to be taught at this level there is need for a great deal of support in the form of materials and in-service training.

What is taught as science and technology?
How are teachers trained?
It was agreed that primary science and technology did not need to be formalised as "topics". What is needed is a science and technology "approach" that instigates enquiry and action leading to student led learning. The ways this could be taught to teachers were discussed. It was identified that this may involve redefining teachers' current knowledge rather than the acquisition of new knowledge. Many teachers have been "doing science" in their classrooms and may know more science than they realise. It was agreed that teachers need to be given confidence; to be given control and feel that they have "power" over science and not vice-versa.

Why include science and technology in the primary curriculum?
The following reasons were put forward:

To inspire students.

To develop "scientific" thinking as an integral part of the learning of any child.

To add a unique dimension to the learning of children in order to help them explore their world and make sense of their world.

Will starting earlier improve attitudes to science; especially among girls?
There was some debate about the question. It was agreed that much more evidence was needed.

G A S A T Conference

Frame 1 Discussion

Question 2: Many developing countries have adopted science curricula written in western countries. In some countries the materials are directly translated. In others the materials are edited to fit the needs of the country. There are examples of developing countries that have developed their own "indigenous" science curriculum. Discuss the advantages and disadvantages of using an "exported" versus "indigenous" science curriculum.

Participants: Total 15: Kenya, Botswana, Sweden, Norway, India, Netherlands, Spain, U.S.A., Nigeria, Sierra Leone.

In Kenya a new Ministry of science education has a new system requiring textbooks to be written by Kenyans and published in Kenya. The emphasis is for students to be self reliant and to be able start their own businesses rather than expect to be employed. There is a similar movement in Botswana. Some books are prepared in the native language for primary school years but there is a shift back to English beyond fourth grade.

In Sweden north and south are quite different and it would be useful to have local curriculum examples. In Nigeria before independence only hygiene was taught but following independence the curriculum was revised. The training and expectations of teachers were upgraded and they began to teach integrated science. The university curriculum had also to be upgraded to accommodate this. Now specialists are advocated in primary schools. In Sweden the question of whether to have science as a separate discipline or to integrate it and focus children's investigation is much under discussion. A complicating factor in all of this is where there are high numbers of immigrants. However whether that is the case or not innovations can and do occur.

In India there is a policy to encourage girls into science. The whole syllabus is science based. It is compulsory for all boys and girls to study maths and science. There is still a lot of work to be done to attract more women into the higher levels of science and technology. In Sweden hard work was done to attract women into technical schools. When 45% were women the men stopped going so that the push to encourage more women was halted for a while.

In the last five years more indigenous or appropriate technology has been occuring in Africa. Indigenous products are competing with commercial products. The utilisation of indigenous technology to improve science education for girls so that science is taught using examples familiar to them at home. There was a problem with some seeing this as "watered down" science. The question of how to remove this stigma was discussed. In Kenya where there is a national curriculum, as elsewhere, having a science curriculum for girls is not possible. However appropriate technology is taught.

The Women's conference in Nairobi in 1985 created the " Green Book" from the Technology and Tools project. The western world has a powerful influence on setting standards for curriculum development, what content is appropriate and what science should be taught. The issue of priorities and strategies for the use of aid money was discussed.

Many countries experienced the problem of girls dropping out of school because of pregnancy. This leaves the upper levels of education male dominated. In Nigeria a "Blueprint for Education" was developed to address this problem, supported by the Minister of Education. It is very important that men and women should work together on this issue.

G A S A T Conference

Frame 1 Discussion

Question 3: The McClintock Collective suggests the use of creative writing in the science lesson (see Gail Hildebrand and Beverley Dick, GASAT, page 172). They suggest that anthropomorphic writing is an effective way for students to gain a "feeling for the organism".

Why is this a good methodology for teaching science topics? Discuss the possibility of "misunderstandings" arising from this type of writing and give ideas for what we can do to correct them.

The discussion centred on ways of creating gender inclusive educational strategies at higher education level. Creative writing formed an important focus for discussion. Issues raised included the question of creative writing and does it reveal differences in the conceptions of boys and girls? Does it consolidate student's alternative conceptions? Does encouraging students to imagine a "soul" keep girls from understanding "real science" and what is "real science" anyway.? Creative writing is only one of many ways of exploring science and can be used as a starting point for testing out ideas. Model building; such as making a tall tower from pins and straws, was discussed as a way of breaking patterns of girls underinvolvement.

The kind of institution creates a different set of problems. A university starts with 18 year olds. Lecturers working in teams with teachers facilitates change as there is already a forum for discussion. Teachers who teach the lecturers in higher education should come from inside the organisation and be qualified in both pedagogy and subject (eg; physics). There is a need for long term staff development and improved financial rewards. In order for change to occur it is important for those trying new ways to be supported. It is essential to have time to discuss how strategies worked and time to make modifications as necessary. Training needs to be undertaken at the time of course planning. Contact hours with students may be lower but involvement with students is higher. Student support in the curriculum can be credited (eg; cross age tutoring). The institution must value its staff by giving promotion for quality teaching and not only research. The lack of training of teaching staff in higher education was discussed at great length.

G A S A T Conference

Frame 1 Discussion

Question 4: Girls are said to be inclined to be more well-intentioned and co-operative in learning situations rather than concentrating on being superior and competent. Traditional physics education however tends to require the students to pursue task and ego goals connected with competency and superiority. Girls can easily be made to feel incompetent in this traditional type of education (see Magda Man in't Veld et.al.,GASAT book, page 172).

Participants : from Britain, Egypt, India, The Netherlands, Denmark, Sweden.....

In competitions if girls are encouraged they can do as well as boys. It is important to define the subject of competition to fit girls' needs so that they get a sense of self-achievement and it's not just a case of winning. Does there need to be competition anyway?

The issue of age pointed to the need for longitudinal studies. In The Netherlands 10 - 13 year old girls participated in hobby clubs outside school hours. similarly in Britain girls were involved in engineering and computing clubs. In Denmark there are no girls only clubs. There is a great deal of discussion about single sex education. In practice teachers manipulate single sex groups for practice work.

There is a great problem of girls' confidence in their own ability as well as making girls value their own ability. Boys need to be made aware of how the girls feel. The attainment of a critical mass of girls in science and technology would aid this. In Sweden schools have a system where pupils remain with the same class teacher throughout, so if there are changes this often produces a regression for the girls' self confidence.

The concept of risk taking was discussed. There was disagreement as to whether physics involves intellectual risk taking that was remote for girls. There was agreement on the social risk for girls of choosing physics. They risk social sanctions from boys, other girls and society in general.

Good experiences in science teaching at primary level were not being replicated at secondary level due to unsympathetic teachers, causing early gains to be lost.

Physics and society courses were challenged by some for being too unstructured. Physics teachers see physics as complex. Inexperienced teachers rely on text books written in a strongly classical tradition. The nature of science was discussed. Issues of the historical process and social motivation and the problem of time needed to prepare both new teaching resources and preparation of classes were raised.

G A S A T Conference

Frame 1 Discussion

Question 5: When girls in western countries are asked if it is possible for girls to become a mechanic or an engineer, they reply,"of course they can!" However, when asked if <u>they</u> could think of becoming a mechanic or an engineer themselves, they often reply,"No".
How can we tackle the "we can - I can't" syndrome?

Most participants worked in further and higher education, interested in the discussion group because the subject was easily generalised to older students. Discussion focused on how to encourage more women school leavers into technical fields (especially computing). An early distinction was made between "we can, I can't" and " we can, I don't want to"; the latter being more difficult to address than the former. The recruitment and retention of women in technological professions was discussed.

The question of how far, especially for girls, deliberate choices were made about areas of study and careers was raised. If we presume that deliberate choices are made then we can attempt to influence the choice at the critical time it is made by providing better information and more positive images. If the process is one of "drift" rather than choice, which some of the group argued, then it is more complicated. The importance of limited single sex tuition was a theme running through the discussion. Self confidence in girls and the merits of some competition were addressed.

The question of how important role models were was discussed. It was agreed that they were important. Also it was agreed that the appropriate choice of role model for the group was very important. An example of this is demonstrated by a role model appropriate to a group of young women not being so for mature women because they did not reflect concerns about things like child care. There are also issues of race and class. Purdue and Sheffield were universities where women undergraduates were used to encourage school girls. It was said that maybe too much was being put onto these women undergraduates.

The question of why so many women in technical studies often so discouraged other women; were so unsisterly, was raised. Moss Kanters's work was discussed on the effect of being in a minority of one and how that effects behaviour so that minorities appear aggressive or unfriendly as a way of protecting themselves. The isolation experienced by women in their professional and private lives was explored. It was felt that the fact that women in professions had these problems should not be disguised. It was felt that most people should be aware that government campaigns to recruit more women into the workforce are mostly based on national economic self-interest. We must keep working to improve the position of all women and keep opening doors for women.

In Denmark there were new theories of teaching physics to 16-19 year olds but "in service" training was limited to one day per teacher which was not enough. An example of introducing a block on electricity (considered most difficult for girls) involved the use of music . Students were asked to close their eyes and listen to music and follow this by writing down what they knew about electricity after which groups were formed to discuss what they knew. In one case girls said that some boys had problems in the countryside when they needed to urinate and there was an electric fence! There was discussion on the importance of teachers needing courage and the need to evaluate what students had learnt and the question of students taking responsibility for learning. There was some evidence that girls preferred collaborative rather than competitive ways of working. Some academics considered that students must do things alone to be good. One participant recounted observing a "typical day" of undergraduate study involving men and women students and their instructors. On theoretical problems male students worked separately and small groups of female students worked together. It is important to help males to admit that they cannot do things. Males may be as diverse as females

G A S A T Conference

Frame 2 Discussion

Question 1: What are the aims of GASAT work concerning higher education?
An equal number of men and women in science and technology. A gender free choice of education for all. To change the course of technological development...?

All seven participants were concerned to consider their own areas of work rather than more specific aims for GASAT. There was strong agreement that GASAT aims should be diverse rather than narrow.

Discussion focused on the proportion of women participating in engineering, science and computing. There is a need for changes in pupil behaviour, teaching methods and the curriculum. It was felt essential to allow women to choose subjects in higher education on an informed basis. They should be able to experience these subjects at school, emphasising the danger of early subject choice reducing later options. There was some agreement that raising the proportion of women has priority over concerns about whether there are sufficient jobs to match increased demand. Also the issue of how women cope when they get into the workplace was raised. There was agreement that moving forward will be by small steps. Teachers need time to reflect upon and share successful strategies and to make choices about changes they can make in their own situations in which they must see a need for change.

The way in which women perceive the work situation of engineers, physicists and computer specialists are often wrong. There is a tendency to see negative aspects, eg; the computer as an object for control rather than as a tool. Also perceptions that engineers and physicists do not deal with people in their work when in fact the opposite is true. There is often a failure to appreciate the variety that engineering encompasses.

Equality of participation in education is not matched in the community in terms of status, power and salary. The status of teaching and engineering varies from country to country. Even when males are in the minority they go to the top. There was discussion as to whether a goal should be equality of participation in the humanities. It was felt that there was a need for cross-cultural studies although it was not clear what their focus should be. Reflective synthesis was thought to be worthwhile.

G A S A T Conference

Frame 2 Discussion

Question 2: In our discussions we often assume that men and women have different attitudes and approaches to science and technology. Is it true?

If we "believe" in differences, and present day investigations don't reveal them, how do we develop new research methods to give a more realistic "proof"?

It was generally agreed that women tended to rate human needs highly compared to men. The concepts of opinion and choice were separated. Girls and boys may have similar opinions but they display different choices, maybe because the criteria applied in decision making are different. Boys tend to choose more theoretical subjects than girls. A recent research project indicated that girls studying physics tended to have similar attitudes to boys studying physics, the same appearing to be true of engineering. Research showed that boys and girls contemplating engineering study held similar attitudes on ethical matters and future careers. It was generally agreed that boys had worse attitudes across the entire spectrum. There was discussion about the influence of childbirth on the attitudes of both women and men. Some thought that both sexes became more reflective following childbirth.

There was an argument strongly put that it was always average differences between males and females that were referred to and that there was a large overlap when comparing teenage boys and girl. The question of whether it mattered and should differences be investigated anyway, was raised.

Curriculum was discussed with questions of who was responsible for the curriculum and the democratisation of course planning. Also there was discussion on who teaches gender inclusive curriculum. It was felt that there was an urgent need to address the issue of teaching students to value each other and improvement in social skills. Although the national curriculum in Britain may help girls by leaving options open until later, this has not had a great effect in Egypt and India where choices are not made until 16. In 10th grade in India girls have a very hard examination if they want to go into engineering, so many decide to go into banking and finance. As many girls are becoming educated and getting better paid jobs they attract "better husbands". Parents are keen to educate their daughters in order to reduce or abandon dowry payments. If women have better prospects than the prospective husband then there has been the suggestion that the man's family should pay a dowry. Girls are becoming more assertive and rejecting marriage until they are established in a career.

It was said that up until now GASAT had focused on girls being the problem when really it was the the direction of science and technology that was the problem. There was disagreement over whether changes in science were necessary. The question of green or environmental issues was discussed in depth. There was a case put for linking with the green movement . It was said by some that if this was not done the area would be studied without women's involvement.

The issue of absolute numbers of women as opposed to critical proportions of women came up. The area of health promotion and the role of women in preventative medicine and community health was introduced. Although in Britain 50% of undergraduate medical students are women no structural changes have occurred in the profession.

The concepts of male and female structures were discussed. Also there was intense debate on the question of whether strategies for change should be overtly feminist or not. Agreement could not be reached on this question. It was argued by some that female engineers rejected those women who announced themselves as feminists. It was generally agreed that the starting point for change was with children and in schools.

There was very little time devoted to discussion on research. However the subject did stimulate strong debate. Qualitative and quantitative methods were compared. Arguments were put that the research problem dictated methodology and that both methodological perspectives could be used together. Some people challenged qualitative approaches. The difference between individual as opposed to team research was briefly debated.

G A S A T Conference

Frame 2 Discussion

Question 3: How do we incorporate science and technology into liberal arts and women's studies curricula? - and womens' values into technical studies?

There were considered to be two ways of incorporating ideas from women's studies into the technology curriculum. Either complete incorporation, which is such a revolution in ideas that it would change every aspect of the curriculum or alternatively a course from a women's perspective or a course component.

The question of how far what is being done in women's studies in western countries is applicable in developing countries was discussed. In India and Africa there is a move to reject imported technology. Science and technology must be exploited for all people, particularly rural women.

The issue of whether we should continue to label areas of study as women's studies was addressed. The concept of women's studies seems to vary from country to country. In some countries women and girls avoid courses which include women in the title. An example is women in management. In other countries specific courses are discouraged from above so courses on women and technology are called "home science and technology" or "family technology". However, in other countries women have been attracted by courses with women appearing in the title, eg; The Changing Experiences of Women. On some technology courses the majority of participants are men and we want to teach them what has been learned from women's studies. In this case it is better to call the course "gender relations".

There was concern about what to do where some kinds of technology frightened some populations because of their inexperience with that technology. An example of this was electricity. Parents are afraid of their daughters dealing with electricity. One way to counter this is to make learning to use the technology an entrepreneurial activity, ie; pay the girls for their involvement. Afterwards they familiarise their family.

G A S A T Conference

Frame 2 Discussion

Question 4: How can we give teachers in engineering education the opportunity to critically reflect upon, analyse and discuss the concepts of:
Equal worthiness, whether it be sex, class or race.
Humane technology, that is, a decent and disciplined use of technical knowledge.

The following are two reports for discussions about teacher education which were clearly different groups. However it is unclear whether or not they actually both fall into this section. For the purposes of editing, it would seem sensible to include both in this section.

Participants: Sweden and Britain.

The group discussed the Swedish teacher education programme concerned with increasing the training on natural science and technology. This applies to pre-service teacher education and in-service education. There is some attempt to integrate consideration of gender issues into these new course programmes, but this is rather limited in practice. There is also an effort to get environmental issues across in the teacher education courses now, but there is still a problem of integrating chemistry and physics into these courses. The tendency is to turn them into a variant of nature studies with the emphasis on biology. The teachers can not readily take on industrial and pollution control issues for example. The issue of relevance to real life science is on the agenda in science education. However biology teachers are doing this better than physics teachers. One participant was carrying out interviews with teachers and students in Sweden on educational methods in use. She stressed the importance of students having more to say in the choice of methods used. The issue of raising peoples confidence was discussed. What was good for school students was good for adults was an interesting point to be developed. Teaching by example was supported, with as explicit methods as possible. Tasters were discussed. Project work and sharing of findings were some of the other aspects raised.

Discussion on methods of assessment occurred. This was not really addressed much in the GASAT papers. It was agreed that assessment procedures were important to consider since they greatly influenced teaching and learning methods. Teachers need more training on assessment methods and an open discussion on their practices during their work. The group briefly discussed the technology-gender issue in higher education. The interest is low in Sweden and Britain because most of the science and technology teachers in higher education are male.

One participant reported on a work organisation worker development project. Here the workers were being developed to

work on a team system to tackle projects on a multi-skill basis. The aim was for the workers to determine what form of training they needed, and for this to be provided informally. She stressed the importance of steering groups representing management ,unions and workers, with the educational facilitators/consultants in support.

Participants: Australia, Denmark, England, The Netherlands and Canada.

After tasters students said that they gained control over science; their own learning and experience changed their consciousness (more than attitudes). The key is to give a critical basis for understanding ones own consciousness because without this it is not possible to control the process in the classroom which constructs knowledge and gender information. The subjective of the pupil was discussed and the importance of recognising their separateness with respect to gender ,race and class. The WASTE report (M Bearlin) put forward that there must be analysis to inform the curriculum; for without it the differences blur.

The issue of whether the analysis of power can be used as a basis for strategies for class, race and gender education was discussed. The question of funding and resources for strategies to make changes for the three groups mentioned was considered. This varied nationally. The question of giving teachers a critical basis to understand their own consciousness was raised. This could be done through addressing values in education (Mc Clintock workshops). Also remembering and recording teachers' own changes in understanding and ways of thinking which are harmful. The process is slow and without the analysis of the process of change the process was lost. The under-confidence of colleagues was very hard to deal with. In pre-service education some teachers were beginning to understand why they had opted out of science.

FRAME 3

WHAT DO WOMEN NEED TO KNOW TO MAKE TECHNOLOGY WORK FOR THEM?
(Extension to third world panel discussion)

1. What are the challenges in science and technology for women? Are they different for women in developing countries, where men don't have basic scientific knowledge.

2. We should also question the direction science and technology has taken in the Western world - this direction has created problems for the world and is self-perpetuating having entered University research/teaching and school curricula. We should not just explore all areas of science just because it's possible (eg embryo experimentation vs basic health care in Australia).

3. The inclusion of women in science won't necessarily make a vast difference because science in the past has demanded the ability of researchers to look back and objectify it.

   Women professionals in science (and engineering) don't classify themselves as women, but as professionals.

4. How to progress?

- Political action - take up opportunities to advise government on scientific/technological issues- always suggest a woman to do this (Australia).

- Allay ourselves to female politicians.

- We need not only scientific literace, but also political literacy.

5. If women have knowledge that is essential to their survival then they can protest and make sure their voices

are heard and science is re-focused. Indian women should be made aware that "indigenous technology" they are using (eg using cowdung as a cleaning agent) is a valid technology. Must persuade government that it should prioritize research projects so that they have different starting points.

Scientists in developing countries particularly must be made to go out of the lab and see what is happening in villages. The Swedshi Science Movement in India is a native movement when scientists (mostly men) go as a group to a village. They have tended to place (or to provide) women in low technologies (eg nut oil extraction). Various women-friendly initiatives in rural India have been possible via patronage of a woman Vice-Chancellor of a University. Science and Technology forum in India has five thousand members - open membership. Members go to a village and discuss what problems there are. They then return and find agencies who will offer help. The forum often has to motivate these agencies to do their jobs eg vacination programmes.

6. In Sweden currently developing curriculum is discussed with students in order to decide what science to retain. Ecological concerns have a central focus.

What can we do about technologies that the Western world has developed, that developing countries don't want (eg nuclear dumping, expired drugs)?

All connected with profit motive upon which we have so little influence. Should GASAT take up one issue at a time and campaign on that internationally eg energy?

7. The picture is so depressing from UK perspective, but Australia has had recent successes eg Girls & Science Centre, Government funded. The situation was very bad though 26 years of the previous government, but now it

has improved. Britain will just have to sit it out!

8. Perhaps young scientists from developed countries could be sent to work with the Swedish movement in India. In Australia the Community Aid Programme may provide finance for travel.

A FUTURE FOR GIRLS IN SCIENCE AND TECHNOLOGY

Pauline Perry, Director of South Bank Polytechnic
London, England

I am very pleased to have an opportunity to speak at this exciting conference, and to share in the discussions which all of you, concerned with the increase of girls and women into science and technology, have been having over the past years.

The title of my talk asks whether there is a future for girls in science and technology. My answer is there must be such a future! It is the birthright of any girl born in this century and living as an adult in the 21st Century, to feel completely at home in the world of technology. The 21st Century, like our own, will be a time when technology pervades every aspect of our lives. I cannot contemplate the prospect of one half of the population – my half, and the world of my daughter and granddaugthers – feeling alien, and denied full citizenship of that technological society. The sociologist Malinowski has said that "in the life history of every individual, from the cradle to the grave, education is that which either bestows upon them the freedom of their culture, or else deprive them of it". Surely it is our task, as educators to ensure that the education of girls and women bestows upon them the freedom of the culture in which they live.

But also, there must be a future for girls in science and technology for the sake of that society itself. I still believe that women have a special contribution to the world of technology, in enhancing and humanizing the design and use of artefacts. Of course, one cannot generalize about individual women or individual men: but the female gender has a predominant share of the humanizing qualities, and the world will be infinitely poorer if that contribution is denied to the development of scientific and technological invention.

So our task is to ensure that girls and women have a future in science and technology. How can we ensure that? I would suggest we can do so in three major ways: via the curriculum: by improvements in the teaching force: and by the contribution of higher education.

Firstly, as far as the curriculum is concerned, I would urge all schools to remember that the curriculum is not only what is written down in the timetables and syllabuses of what is taught: everything about the school is a statement, and a statement which girls read and hear most clearly, as they enter the school. If the school is a place of colour, life and grace, where the opinions and work of girls are valued, and where human values predominate, then girls will feel at home there, and will be able to flourish and grow. Too many schools convey a message which is alien to girls. They are cold, bare and alas often dirty. I would like to see all schools girl-friendly, providing an environment which in all aspects of their learning encourages the best in the pupils, both boys and girls.

We are fortunate in England in having now achieved agreement on a national curriculum which should ensure that girls continue to study the subjects related to technology at least up until the age of 16. I do appeal against a system which allows too many options, too many choices, which results in girls choosing the subjects which they believe are feminine and non competitive with the boys. Is is far too easy for a Head teacher to believe that a rich variety of choice on offer results in a rich variety of experience for pupils: too often it means the reverse, and the wider the range of options, the more likely that girls will choose a full subset within one confined area of the curriculum. Similarly, I would appeal to schools to use subject titles which are attractive to girls, and to ensure that the classrooms which deal with science and technology are bright, attractive and clean.

Similarly, I would ask for teaching methods which encourage girls to develop confidence, and an understanding of scientific method right through from the early years of schooling. The context in which subjects are taught is vitally important to girls, as research has shown. The fascinating analysis of the results of girls performance on our national tests for the Assessment of the Performance Unit, showed that, for example, girls "couldn't" draw a diagram explaining how a simple electric circuit worked, when they were asked the question in direct scientific terms only, but they could design elaborate and effective electrical circuits, when asked to design a toy for children, which would reward the child with a flashing light, when the child gave the right answer! Context, as I said, is everything.

My second strand is the teaching force, and I make my heartfelt plea for better training for teachers in the elementary stage in science and mathematics. In our country, 80 % of the teachers teaching in elementary schools are qualified in humanities and the social sciences and not in science and mathematics. Given that an even higher proportion of those elementary school teachers are women, the message is conveyed from the earliest days in school "women don't know about science and technology". I believe the most fundamental attack we can make on the problems of girls in science and technology, is to change the ethos of the elementary school teachers, and to encourage more women teachers into technology in the secondary school. We cannot really expect girls to choose science and technology for their advanced studies in the secondary school if every lab and workshop is presided over by a large man in overalls with dangerous looking tools and equipment littering the benches and walls!

Lastly, I would appeal for a better contribution from higher education institutions to this problem. In my own institution, we have discovered that an aggressive recruitment policy for mature women, which provides them with special access courses to bring them up to degree entry standard level in

mathematics and science, encourages many women to enter fields which they had previously considered closed to them. We are able to boast that we have twice the national average of women in our engineering courses – but this is a pathetic 17 % against a national average of less than 9 %. We must address all the possible avenues for encouraging mature women, many of whom have discovered as they move into jobs where they are using technology and mathematics, that they have real talents in this area which their schooling had never developed. Special courses to help them to develop their confidence and skill will, I am convinced by our experience, greatly increase this route into higher education for women in science and technology.

So I ask again the question, is there a future for girls in science? I answer it by looking at this audience and their committment and determination and give a resounding "yes"!

THE GASAT ASSOCIATION

Two meetings were held to discuss developments in the formation of a GASAT Association. Jan Harding reported on decisions taken at GASAT 5

1 **Objectives**

Objective 4 in the original discussion document had been eliminated, but was represented to a certain extent in a "Mission Statement". The presentation of an Association is therefore as follows.

An Association of those concerned with issues arising from interactions between Gender and Science and Technology

Mission Statement: To foster socially responsible and gender inclusive science and technology.

Objectives:

- To encourage research into all aspects of gender differentiation in science and technology education and employment.
- To foster gender equity in science and technology education.
- To facilitate the entry of women into employment in the fields of science and technology, and their progress within such employment.
- To provide a forum for dissemination and discussion of research findings and experiences of those working in the field.
- To provide a support network for those working towards the objectives outlined above.

It was pointed out that the objectives now referred only to the "gender inclusive" science and technology part of the Mission Statement. No objective addressed the fostering of "socially responsible" science and technology.

2 **Membership**

It was suggested that Institutional membership should be vetted by the Board and should carry no voting rights.

3 **Interim Board**

Great concern was expressed by many participants, including those from India and from African countries, that someone from South Africa had been elected to the Interim Board. It was noted that she was in no way considered to be a representative for Africa. The formation of a properly constituted Board, elected by members from regions should be regarded as a matter of urgency (before GASAT 6).

An appeal for volunteers for the positions of Executive Secretary, Treasurer and Newsletter Editor was made. It was recommended that any person appointed to these positions should have attended at least one international GASAT conference.

By the end of the conference the following offers had been received:

Executive secretary:	Lesley Parker (W Australia)
Treasurer:	Leonie Rennie (W Australia)
Newsletter:	An Open University Group (UK) working as a collective: Gill Kirkup Patricia Murphy Liz Whitelegg

Regions:

At a second meeting, participants divided into groups to discuss and to make recommendations for regional representation on a GASAT Association Board. Some creative proposals were considered but a final recommendation was as follows:

Criteria for identifying regions:	geographic proximity cultural similarity
Balance of representation:	number of members cultural diversity

Regions	Area	Representation
	Europe (incl Middle East	2
	The Americas	2
	Africa	1
	Asia	1
	Australia & Pacific	1

Elections

The Board should be elected by postal ballot before GASAT 6 (1991). The Constitution of the Board should be reviewed at GASAT 7 (1993).

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A Personal Summary of Frame I

Leonie Rennie
Science and Mathematics Education Centre
Curtin University of Technology
Western Australia

Before offering my personal summary of Frame I: Primary and Secondary Schooling, I wish to thank all of those participants who shared their research and experiences with us in this frame. My comments are based on the papers I have read and the discussions I have had with you during this busy and exciting week. Thank you for sharing your thoughts with me.

Putting the "Sigh" into Science

I will begin by relating something that happened two years ago, because many things on Monday reminded me of this event. It was a conversation between my daughters at the dinner table one evening. Susan (aged 8 years) said "Today, in our music class, the teacher asked some of us to sigh. But I didn't know what to do". Robin (aged 11 years) was disgusted. "Susan!" she responded "How come you didn't know how to sigh? Trixie Beldon (the central character in many of their story books) sighs all the time!" Susan replied "But I only read her sighing - I don't see her sighing!"

At the time we laughed, but what Susan said has a message which is important to this Frame. It is the importance of vicarious, or first-hand, experience. Susan found that to read is not necessarily to learn.

In their plenary session for Frame I, Anne Lea and Doris Jorde asked us to write about "What Constitutes a Good Primary Science Program?" I believe the most essential element must be that of experience. If pupils do not experience a meaning and a context for what they have the opportunity to learn, they are unlikely to learn it. Science is the most fundamental subject of the curriculum. It is fundamental in the sense that the child's first explorations of her/his environment provide the stimulus for communicating, and thus the stimulus for the development of language. The need for mathematics is secondary to science, because mathematics is a tool for describing the world, for measuring changes, for predicting the direction and extent of change. So, when science is defined in terms of exploring, experiencing and understanding our environment, language and mathematics become less central to the curriculum. Many times this week, the importance of science in the primary school has been recognised. Science is not an "extra", something to be added if there is time. Science can provide many experiences to stimulate learning in language and mathematics.

Whilst many of our experiences are cognitive, there are affective experiences, too. You all will remember the two stories of Lisa Jane. Beginning at her birth, her experiences affected the games she played; the way she was treated at school; the subjects she thought she could do; the career she eventually chose. It is clear that different experiences lead to different conceptions of the world, in term of what things are, how things work, what is important to me, what I can do.

When different experiences are related to the gender of the student, there has accumulated overwhelming evidence that the resulting differences in conceptions of the world are reflected in pupils' attitudes, but not in their ability. Earlier research reporting gender differences in ability can no longer be supported. What still is evident, however, are gender differences in achievement on assessment items which relate, in one way or another, to differences in the background experiences of girls and boys.

Perceptions of Science and Technology

Many papers, discussions and presentations, referred to a lack of self-confidence in doing science and technology, felt not only by girls, but by primary school teachers, most of whom are female. Why is this so? Reference was made in some discussions to the "We can, I can't" attitude. Why do many girls and teachers feel afraid and alienated from science and technology? Part of the answer lies in the way science and technology are perceived. At primary and lower secondary school, pupils and teachers do many activities and have many enjoyable learning experiences which are about science, but aren't recognised as science because they may happen in lessons labelled mathematics, social studies or craft. When this happens, the understanding and enjoyment of science as an active process is missed. Instead, science becomes a label for the content of science lessons. Perhaps teachers would feel more empowered if they did recognise science as a dynamic process, an activity associated with problem solving, instead of a complicated body of knowledge. Unfortunately, many people see science only as content, divorced from its process, and sterile, irrelevant, decontextualised. Science as something to learn to pass examinations. As Juliana Amara said during the panel discussion, science from textbooks is science as history.

The Balance Between Content and Process

In many countries, including my own, and particularly at the secondary level, the content of science is frequently taught without consideration of the process. But whilst science content can be taught without process, the processes of science cannot be taught without content. The science processes of exploring, explaining, predicting, testing, have to include content. But what content? This was another question posed to us this week

There are different answers to the question of what content, and they depend on the circumstances of the teacher and the pupils. The needs of pupils of different ages, in different countries and the resources available to teachers are some of the issues to consider. However, I think that there are two general characteristics which can guide selection: The content must not only be relevant to pupils' experiences, it must also extend them. Relevant means using plants and animals which are familiar to pupils, studying materials and processes that are appropriate to their community, and posing problems that are meaningful to pupils, problems that have a recognisable need to be solved. The selection of content which extends pupils' experiences is just as important. As Patricia Murphy and Anne Qualter point out, solving everyday problems with everyday equipment is fine, but sometimes it only leads to ordinary, everyday solutions. Pupils do not automatically progress to perceiving a need for rigour in measurement and controlling variables when doing science activities. There must be a need created for an increasingly higher level of content, understanding and precision in the use of equipment as the pupils progress through school into tertiary level.

Teaching Science and Technology

During the years of GASAT, there have been reports of teaching methods in science and technology which recognise the diversity of experiences and conceptions held by girls and boys. This year we have learned of more -- the gender-inclusive strategies developed by the McClintock Collective are one example, and we have experienced others. There has been recognition at this conference that gender-inclusive strategies are not just good for girls, they are simply good pedagogy. Not only are they suitable for girls and boys in the primary and secondary schools, and higher education, but, as Jayshree Mehta explained, this kind of experiential learning is appropriate for rural women in India as well. But knowing about these teaching methods does not mean that the problems of teaching girls and boys equally well are solved. The use of such strategies requires commitment and motivation by the teacher. Juliana Amara has

written about the "naked classrooms" in her country. Lack of material and financial resources means that the urgency of using gender-inclusive strategies becomes secondary to providing conditions in the schools which enable science to be taught at all.

Future Directions

In looking towards GASAT 6 and beyond, there seems to have emerged three major areas related to primary and secondary schooling in which we can work for further advances. First, there will be more formal evaluations of the gender-inclusive strategies and other innovations which promote the participation of girls and boys in science and technology. There may be a consensus among ourselves that such methods work, and the weight of positive experiences cannot be ignored, but there is still the need for evaluation to demonstrate the short and long term effects on teachers and pupils and to give others a reason to change. Second, there is an urgent need for more research into methods of assessment which are gender-fair. As new procedures for assessment and certification are introduced in many countries, and different methods of teaching are adopted, we must improve our understanding of how girls and boys respond to a variety of assessment techniques, and which techniques are appropriate for fair and equitable assessment. Third, in most areas of our research on gender we are beyond the documentation of differences. There will be further studies which quantify the variables we wish to measure, but they must be enriched by the probing techniques of qualitative research methodology. This does not mean abandoning our quantitative tools, rather, it means recognising that there are many ways to find answers to our questions. It is up to us to choose the best.

A personal summary of Frame 2

By

Juliana Amara – Sierra Leone

GASAT is composed of people with a common interest and goal. The fact that these people come from diverse backgrounds and geographic locations is considered to be special and unique.

However, this diversity can cause problems in expressing views and planning intervention programmes. The same problem can assume different magnitude in different parts of the world, and the ease or difficulty with which intervention programmes can be implemented may vary from place to place. These points should be born in mind when people from diverse backgrounds discuss a common problem.

Thus, this being a European and third world GASAT, I think it is appropriate to remind ourselves of some similarities and differences between these two parts of the world in relation to the goals and objectives of GASAT.

SIMILARITIES

1. Low female participation in science and technology

This is a common problem in both European and third world countries. Both are therefore fighting a common battle to redress the situation.

2. Factors which bar the way of women into science and technology

These are basically of two broad categories; those imposed by society and culture, and those imposed by the biological function of the female body making it the bearer of children.

3. Strategies of solving the problem

These include re-designing the curriculum to attract girls; change the attitude of females about science and technology; creating a more positive self-image among females and changing the attitude of society about females.

DIFFERENCES

1. Consiousness of the ill-effects of gender in-equality

The third world has entered the campaign against gender in-equality only recently as compared to European countries. Thus a large percentage of third world people have notcome to accept sex-inequality as a problem. Sensitizing people about this problem should therefore be an important intervention strategy in the third world.

2. High illiteracy rate

Unlike Europe, the majority of third world people are illiterate. They reside in rural areas and in subsistent ecomonies. Over 60 % of school-age children do not get enrolled in schools. Of those who get into schools a very large percentage drop out before finishing. This drop-out rate is much higer for women than men.

3. Scientific and technological advancement

This is much lower in the third world than in Europe.

As can be seen from these differences, third world people have a complex battle to fight – the fight to raise consciousness about the ill-effects of gender in-equality, to overcome illiteracy among women and to increase female participation in science and technology.

This fight against gender in-equality in the third world is not only a moral issue but also a necessary strategy for development. Third world countries being far behind European countries in scientific and technological advancement, cannot afford to leave behind the women (who make up half of the human potential) in the march to development.

This fight is however made more difficult for the third world by the general economic malaise in these countries. The poor economic situation of these nations yield little or no educationalfacilities, little or no teacher motivation, and little or no learner motivation. Consequently, education may not be a priority for people whose basic life requirements cannot be met.

However, one should bear in mind the fact that inspite of their illiteracy and poverty, third world women have a wealth of education within their own culture and tradition: the vast knowledge in the use of medicinal herbs, the production of intricate arts and crafts with complex geometric designs and precise measurements, the use of indegenous technology to preparing certain products mainly of which have some basic scientific processes and principles etc. These should be used as foundation stones to build upon what is already

known. How this can be done should be a major issue at National GASAT's of the third world.

With these points in mind, let us now look at what happened in Frame 2 of this conference.

This Frame addressed issues that pertained to women in higher education. Many issues were raised in the formal papers, round table discussion, workshops and poster presentations. These issues can be summarised in one word – CHOICE!

Do women in higher education choose science and technology? If yes, what are their motives? If no, what are the barriers and solutions?

Encouragingly, it was shown in this Frame that the number of women in science and technology is increasing. They are however still in minority and are still avoiding the hard sciences.

The barriers identified included:

a) inadequate science and technology education at the lower levels of education.

b) poor image of science and technology

c) social stereotypes and prejudices.

These problems have been identified as far back as the beginning of GASAT. They are therefore not new problems. Future GASAT activities should therefore focus on international comparisons of the magnitude of these problems in different countries.

Among the solutions discussed were the following:

1. Intensifying teacher training and curriculum development for primary science teaching

Primary science has not received adequate attention in many educational systems particularly those in the third world. Women therefore lack the necessary foundation and motivation to take it up at higher levels of education. An innovative primary science programme reported at the conference was "Teknikens Hus" in Sweden. With the necessary support, such a programme can be desseminated in other parts of the world. A good example of primary science programme in the third world is the Science Education Programme for Africa (SEPA).

This programme is not very functional now, due to many logistic problems. Revining and desseminating this programme would be a good GASAT project in the third world.

2. Improved teaching style at the higher levels

It was shown in this Frame that female students prefer flexible teaching styles that involve them in the learning process, rather than being only passive teachers. This demand necessitates improved training of teachers.

3. Intergrating gender issues into the curriculum

This is considered necessary but should be carefylly done to avoid resistance from female students, who do not like special attention. Also a programme that is too female-specific may be considered watered-down and may be avoided by both male and female students!

4. Mutual support and networking

Women who select science ant technology at the higher levels need support from eachother. To reduce the fear of failure which often keep women away from this field, a channel through which this support can be provided should be worked out.

This idea of support and cooperation was taken further to the international level as was seen in round table discussion on "Women in Techbnology in the European community" (The WITEC-UETP). This is a European Network of partners working for the motivation development and support of women in science, technology and enterprise. It would be a good idea to initiate such a programme for the third world.

5. Policy formulation and implementation

An appropriate policy and its implementation is a good way of reducing barriers for women into science and technology. In this Frame the Foundation For Women and Higher Technical Training (VHTO) was introduced. This is a national organisation in the Netherlands which aims at improving the position of female students in technical education.

6. Need for guidance and councelling

It is evident that the choice of a cource can be motivated by the relevant information on career opportunities in that discipline. Very often school girls (and boys) do not have the correct information or have only a vague picture of career possibilities in technical courses.

The EVENT project in the Netherlands was introduced as a poster presentation in this Frame. This project aims at increasing the number of girls in science and technology, through guidance and counselling. The project develops and uses vocational guidance materials for secondary school girls. It seeks assistance from teachers and enthusiastic women in implementaring its plans.

Like all the other Frames in the conference, Frame 2 had a rich collection of activities. The numerous points raised in this Frame have not all been mentioned in this summary, However, the major issues raised here can give a good idea of what happened in Frame 2.

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Personal summary of Frame 3 by
Radha Chakravarthy, social scientist, from India

National Institute of Science, Technology and Development studies (CSIR)

Established in 1981 – aims at generating information, knowledge and expertise in the field of science and technology policies and in particular their use in the process of development

GASAT APPROACH

Encouraging women

Networks to unite their strength

Special projects to analyse womens' issues Regional/National/International

Newsletters:
Exchange information on projects, about conferences, about institutions concerned with women studies.

Lists of women scientists, who have received awards

Information on database

Information on legislations concerning women

Encouraging support to the Empowerment of women in the third world countries

To look into the issues of the international board.

Liberty is not reached by a singel bound
but we will build the ladder by which we will rise

Taking science and technology to women in rural/urban sector

- Historical, socio-cultural heritage
- making use of traditional knowledge and practises of women in science and technology development
- Awareness of their own environment
- need broad technology
- documentation of scientific knowledge
- science is to be continued as part of daily life

WORKPLACE PROBLEMS AND OPPORTUNITIES IN DEVELOPING COUNTRIES:

Questions:

- How are girls doing and should we encourage girls in science engineering?
- How can women be supported in workplace – problems and barriers?
- Changes needed – coping strategies.

Strategies:

- Legislation supportive to women, equal pay for equal value
- Changing the attitude of men in the workplace, self-evaluation of women

GASAT OBJECTIVE:

To facilitate entry of women into employment in science and technology and their progress within such employment.

Personal summary of Frame 4 by
Ann Holmes

When asked to give a "personal" summary, I found myself faced with the question of what constituted the "personal". Was there an international norm? Was there a feminist norm?

With the proviso that Frame 4 representing the meta level of ethical, moral, philosophical and methodological issues - is hard to separate out, what follows is what jumped out at me.

Our successes are coopted (Carter/Kirkup); the medical establishment tries (often succeeds) to control women (Walton) and we volunteer our labour - all over the globe.

I understood Everts to say that feminism is that aspect which is worth retaining, worth teaching to men - and - a GASAT goal was to change science so it leads to a better world, a "Transformation" (Kock).

The question is **how**. When women and their work are not valued by the "power" structure in many countries. If we demand our rights, we must accept our responsibilities. If we want to change science to transform the world, can we also look at our own careers - what's in it for me? The Kenyan women do other jobs but they are most happy farming. We are powered by anger, dissatisfaction, altruism and self-interest.

I was reminded of the various scales along which we swing.

focus on task	focus on process
challenge analyses (theory)	accept differences (local experience)
	– concilliate
self	group
new to issues	experienced support
impatient	patient
over–achievers	lazy, complacent
many issues at once	fewer criteria

The notes are compiled with thanks to those collegues and friends who assisted me.

They are written for those who are working for transformation in memory of 14 female students, who were murdered because of their gender and their chosen field, at l'Ecole Polytechnique Montréal, Canada 6 December 1989.

"First mourn, then work for change"

EVALUATION OF THE CONFERENCE

On the final morning of the Conference participants were asked to complete a simple evaluation sheet. It was the one used by the McClintock Collective to evaluate in-service activities with teachers. This asks for responses to the following sentence stems:

I liked.....

I thought.....

I learned.....

I would have liked....

Some participants had already left the conference; about half (38) of those remaining returned the sheet. Their words are used below to report the evaluation.

I liked.....

There were many warm, appreciative comments on the wonderful, effective and smooth organization. There was a good use of time, a nice mix of work and entertainment. The pacing was not too frantic, we were fruitful and busy and it was good, at times, to work so intensively. Many liked the variety in the programme, the mixture of workshops, discussions, and presentations.

A number specifically mentioned the value of the plenary sessions (and the creative talent revealed), although others would have liked fewer formal sessions.

It was good to discuss with people doing similar work, to exchange ideas and to learn from experiences of others. The atmosphere was relaxed and helped communication, it was kind and warm, continuously friendly and supportive. It was tolerant, accepting difference and giving respect to all. It was so different from other conferences organized usually by men. Many delighted in meeting old friends and in making new ones. The experience of the strength

subject areas?How can I contribute to the next Conference? I'll come again!

The special experiences of GASAT were uppermost for some:- it is unique, GASAT illustrates that the *personal is political*. We must tackle GASAT problems by applying our working ideas - conflict resolution and collaborative group working. We should use the latter to get a more effective evaluation of the conference.

The cooperative atmosphere helped us through some difficult issues. GASAT is a kind of network that is worth fighting to keep going and perhaps we all need to do this.We need to make a 4 week conference!

I learned .....

.....a lot! (was a common response)

More specially participants learned about India and Africa and much from the Indian and African women.

The issues of women and science are universal, but cultural and political factors result in important differences. There are many perspectives, but problems are not unique - others have 'keys' so the way becomes more clear. The strategies one can use depend on school systems which create problems for collaboration.

Some learned more to help their own work others about work in other fields. New ways to teach science, and especially primary science, were mentioned more than once.

Other specific learnings were: exchanges can lead to new and challenging directions and new ideas for research. You see how to be more creative in existing work, how to work in groups, that we need to put the 'sigh' back into science*. Feminism can provide a useful framework, but is feminist science the same as responsible science?

Some found they were learning to listen,especially to different points of view, to contribute in spite of the language problems, to be diplomatic.

and involvement of so many women was appreciated. The women were powerful and inspiring but without imposed hierarchies. The Conference was enriched by the very impressive women from the so-called Third World.

Other aspects specifically mentioned were; the idea of the four frames, the notion that we are all developing countries when it comes to women, the posters as a way of sharing people's successful actions, the 'manipulative' workshops, the Girls and Physics Symposium, the Panel on Third World issues, the really international feel, a sense of European identity and the chance to stay with a Swedish family.

The comfort of the hotel was appreciated and its pool (though this could have been bigger!). The peaceful location, the lake, the boat trip, the weather, the breakfasts, the personalised badges, the dancing and the fun all contributed to the enjoyment experienced.

I Thought.....

This category prompted participants to reflect on a wide range of issues. Some took a further opportunity to comment on the hard work put into the organization of a very successful conference. The conference committee did a wonderful job and retained their composure at all times.

There were hints of earlier apprehension:- fears that it would be harder, ... the language (English) would cause bigger problems. ..... that discussions from different backgrounds would be difficult, but it was good to make the effort to bridge the gap, to communicate across cultures and different theoretical positions.

There was plenty of opportunity to contribute to discussions but poster papers were neglected. The Third World contributed a good learning context. There were many interesting experiences to learn from in GASAT.

Questions were raised:- Why is social class neglected in discussions about gender? How were Third World people chosen? Why Costa Rica and not Nicaragua? How can I build on what I have learnt? How can I integrate more people in my own country into work in this field? Could we extend to other

It was encouraging to find there were others still interested in girls and physics, that there were many people and organizations working to change science and engineering,that we can have networks and pressure groups and that we can experience the real friendliness of women.

We learned much about Sweden and its beauty in springtime and to raise the hand to make silence!

* This is a reference to Leonie's daughter who had read about sighing, but did not know how to do it.

I would have liked .....

Several participants mentioned more time for reflection - afterwards is often too late. One suggested the use of a 'home group', an international group of not more than 8 people, with a specific time each day to meet together to reflect on experiences and to get to know each other.

Others wanted more time for informal discussions, for discussion groups to go deeper into issues, to develop comparative projects and to learn from others.

There was mention of less plenary talk, of more panel discussions, of guest speakers keeping more strictly to time and of more structure to discussion groups, with a clearer focus on the chosen topic.

One participant would have liked the theoretical framework of feminism to have been presented at the beginning of the programme, another that more prior information about workshops had been available, that there had been more opportunity to discuss the videos and several felt the poster papers had not been given enough programme time. There was a suggestion that abstracts of people's research/action/special interests should be published as a directory.

Aspects that some would have liked to be better represented were:- women in working life, women in computing, and the development of girls and women in connection with their bodies as well as their minds. We should have allowed time for the small group working on the GASAT Association representation to report back.

Some would have liked;- a wider world representation, more women who were working scientists, more men who were working on masculinity, gender and science and more participants from Latin Americia and from Eastern Europe.

Only one would have liked a shorter conference, others would have had it longer, but 4 wanted a different structure, with 3 or 4 parallel frames and one the chance to spend longer on a theme, (say half-a-day).

Personal needs were expressed: I would have liked .... to be more active and outspoken, to participate more (I must practise English at home), to speak better English, to know what standard is required for the contributions and the experienced ones would have been more patient with us newcomers.

The more practical things needed were:- more access to shops (especially for postcards and stamps), access to late night tea and coffee, cheaper food, somewhere to wash clothes, more physical activity, more dancing and a chance to see Jönköping, local culture and the Hogskolan, although one deplored the small size of the group participating in the industrial visit.

These comments show an overall very positive response to the Conference, its organization and 'atmosphere'. The chief dissatisfaction that emerges is the lack of opportunity to go more deeply into particular aspects. This is demonstrated by the general comments about shortage of time and in the proposals for parallel sessions running throughout a conference. We must find some way of meeting this need in the future without loss of coherence and the learning across fields that many currently appreciate and without the separation of experience from those new to the problems of Gender and Science and Technology.

Jan Harding.

Closing of the Conference

Ingrid Granstam

We have come to the last day and the last session of this conference. The days have flown by and I have to say THANK YOU for five fantastic days. Personally, I have learnt a lot from you during these days and I hope, you can say the same! It has been exciting to meet and to hear about your different projects to interest young people in subjects like technology and science. Now I hope we all can continue our work in our own environments perhaps in a new and inspired way from what we have learnt from this conference. Let us work towards our theme "Science and Technology, a Future for All!" Again, I want to say THANKS A LOT EVERYBODY for your attention and interest.

I am greatly thankful to everybody, who has had special responsibilities during this conference. Those of you, who have worked with our different FRAMES, given lectures, round table discussions, symposia or workshops have given much to this conference. Also the ones, who have helped us plan the conference and arrange it. We thank you all very much.

At last, I want to say, GOOD LUCK in the future. GOOD LUCK with your work! and a safe journey home. I hope, we will meet again some other time perhaps in Australia next year at GASAT VI? Till then - GOODBYE!

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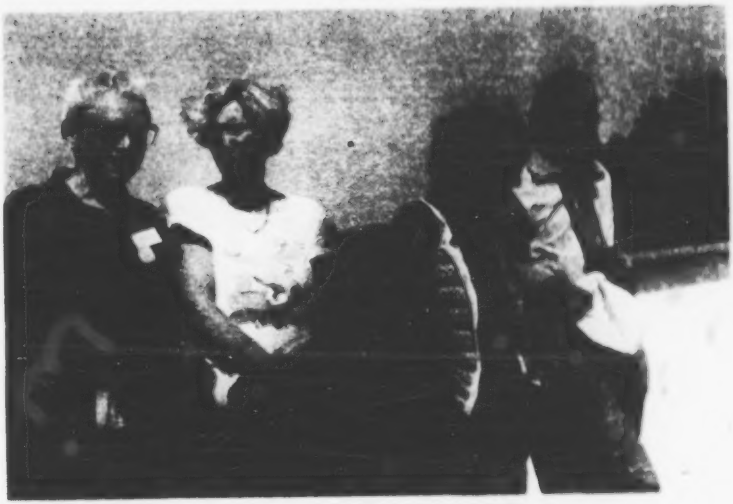
Feelings of the meeting

To talk and to tangle
to work on an angle
to speak and be silent
are both equal here.

Be warm if your lonely
we all can be homely
there where the people
can feel themselves well.

The strength is enduring
like light in the morning
in summer the sunrise
can never set

Anonymous



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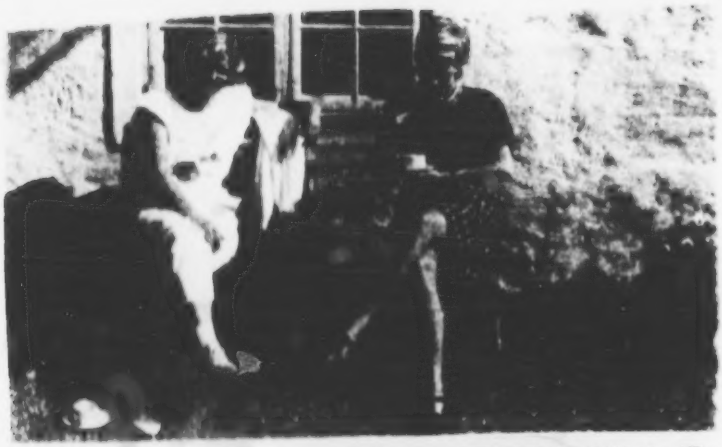

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